AD-A085 890 FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH F/G 13/1
INSTRUCTIONS ON THE DESIGN OF BOILER INSTALLATIONS SN 350-66.(U)
MAY 80
UNCLASSIFIED FTD-ID(RS)T-0427-80 NL

1 OF 2
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AD-A085 890

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FOREIGN TECHNOLOGY DIVISION

INSTRUCTIONS ON THE DESIGN OF BOILER INSTALLATIONS SN 350-66

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FTD- ID(RS)T-0427-80

UNEDITED MACHINE TRANSLATION

(12) 186

(14) FTD-ID(RS)T-0427-80 (11) 19 May 80

MICROFICHE NR: FTD-80-C-000584

(6) INSTRUCTIONS ON THE DESIGN OF BOILER INSTALLATIONS SN 350-66.

English pages: 183 (21) Unedited machine transl. mono.

Source: Ukazaniya po Proyektirovaniyu Kotel'nykh Ustanovok SN 350-66, [redacted] Moscow, 1967, p 1-83.

This document is a machine translation
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Block	Italic	Transliteration	Block	Italic	Transliterati...
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, ...
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yë or ë.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	Engli...
sin	sin	sh	sinh	arc sh	...
cos	cos	ch	cosh	arc ch	...
tg	tan	th	tanh	arc th	...
ctg	cot	cth	coth	arc cth	...
sec	sec	sch	sech	arc sch	...
cosec	csc	csch	csch	arc csch	...

Russian	English
rot	curl
lg	log

Instructions on the design of boiler installations SN 350-66.

Are affirmed by the State Committee of the Council of Ministers of the USSR on matters of the building on 14 June, 1966.

"Instructions on the design of boiler installations" (SN 350-66) are developed by the state design institute "Santekhproyekt" GOSSTROY of the USSR with the collaboration of the central boiler and turbine institute im. I. I. Polzunov the ministries of Heavy, Power and Transport Machine-building, State Design-research Institute "Transelektroproyekt" of the Ministry of Transportation Construction, State Institute for the design of the gas-scrubbing constructions "Giprogazoochistka" of the Ministry of the Oil-refining and Petrochemical Industry of the USSR, state design Institute "Promenergoproekt [State All-Union Planning In-t for Planning of Const. of Indus. Heat and Elec. Power Plants for Supplying Power to Indus. Estab. of All Branches of Nat'l Economy]" of the Ministry of Energetics and Electrification of the USSR.

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(1) Государственный комитет Совета Министров СССР по делам строительства (Госстрой СССР)	(2) Строительные нормы (3) Указания по проектированию котельных установок	СН 350-66 в

Key: (1). State Committee of the Council of Ministers of the USSR on matters of building (GOSSTROY of the USSR). (2). Construction norms. (3). Indications in accordance with design of boiler installations.

1. General considerations.

1.1. Present indications are comprised in development of chapter SNIP [Construction norms and regulations] II-g.9-65 "Boiler installations. The norms of design" apply to the design of those of newly constructing and are reconstructed boiler installations with the cast iron sectional boilers, by steam boilers with the pressure of steam $\leq$23 atm(gage), by coefficient of evaporation to 75 t/hs and by hot-waters boiler with the temperature of heating water to 200°C, by heating power to 50 gcal/h inclusively.

Note. Indications do not apply to the boiler rooms of power stations, to the boiler rooms with peak hot-waters boiler, intended for the work in the block with the heat and power plant, to the boiler rooms with boilers-utilizers, or to the movable boiler

installations.

1.2. During design of boiler rooms, besides requirements of present indications, should be been guided by appropriate chapters SNIP, rules and other standard documents.

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1.3. In depending on character of thermal loads boiler installations conditionally are subdivided into three basic types:

(1) Внесены Государственным проектным институтом «Сантехпроект» Госстроя СССР и ЦКТИ им. Ползунова Министерства тяжелого, энергетического и транспортного машиностроения	(2) Утверждены Государственным комитетом Совета Министров СССР по делам строительства 14 июня 1966 г.	(3) Срок введения 1 января 1967 г.

Key: (1). They are introduced. By state design institute "Santekhproyekt". GOSSTROY of the USSR and TsKTI im. Polzunov. Ministries of Heavy, Power and Transport Machine-building. (2). They are affirmed. By state committee. Council of Ministers of the USSR for matters of the building on 14 June, 1966. (3). Period of introduction on 1 January, 1967.

heating - developing/depleting heat for the heating, the ventilation and the hot water supply of habitable, public, industrial and other buildings and constructions;

heating-production - developing/depleting heat for the heating, the ventilation, the hot water supply and the technological targets;

production - developing/depleting heat for the technological targets.

1.4. Calculated heating powers of boiler rooms are determined:

for heating ones - by sum of maximum hourly consumptions of heat per heating, ventilation also of calculated hourly consumptions of heat per it is hotter water supply;

for heating-production and production - by maximum hourly consumption of heat on the basis of diurnal graph of heat consumption (taking into account work of storage batteries/accumulators of hot water and steam).

Note. During the determination of the calculated heating power of boiler room must also be considered the heat losses by thermal networks/grids and heat consumption per their own needs of boiler room.

1.5. Maximum hour calculated heat consumption per our own needs of boiler rooms should be accepted in size/dimension to 3o/o of established/installed heating power of boilers.

1.6. Selection of heat-transfer agent and determination of heat consumption per heating and ventilation of buildings and constructions is manufactured according to data of chapters SNIP II-g.10.62 "Thermal networks/grids. Norms of design" and II-g.7.62.

"Heating, ventilation and air conditioning. Norms of design". Heat consumption per everyday hotter water supply are determined according to the data of chapter SNiP or II-g.8-62 "Hotter water supply. Norms of design".

1.7. Thermal loads for calculation and selection of equipment of boiler rooms must be determined for four characteristic modes/conditions:

maximally winter - at calculated temperature of surrounding air for designing heating (calculated heating power of boiler room);

coldest month - at mean temperature of this month;

average-heating - at mean temperature of surrounding air during heating period;

summer - determined by rates of discharge of heat per technological targets and is hotter water supply.

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1.8. Number of boilers and their unit heating power should be accepted:

for heating boiler rooms - in value of calculated heating power of boiler room without the installation of spare boilers;

for heating-production and production boiler rooms - in value of calculated heating power so that during the malfunction of one boiler those remaining would provide consumption/production/generation of heat in quantity, determined by mode/conditions of "coldest month".

In the boiler room it is necessary, as a rule, to provide for the installation of the uniform boiler units of identical heating power.

1.9. In boiler rooms of which it is not required continuous feed of heat, is allowed/assumed installation of one boiler.

1.10. If necessary for increase in heating power of boiler room should be examined advisability of installation of additional boilers, modernization of those existing for increase in their heating power or replacement of existing boilers by boilers of larger productivity.

1.11. Composition, content, order of development, agreement and

2.4. For boiler rooms, arranged/located in residential areas, one should apply gas, high-grade solid fuel and low-sulfur petroleum residue.

2.5. Design characteristics of fuels/propellants are accepted according to data of standard method of thermal design of boiler aggregates/units, developed by VTI and TsKTI, or according to propellant property of concrete/specific/actual deposit, indicated in assignment for design.

2.6. For boiler rooms with annual expenditure of natural gas to 10 mln. m³ work on other form of fuel is not provided for.

With the annual flow rate of natural gas of more than 10 mln. m³ the need for the work of boiler room on other form of fuel/propellant (petroleum residue or solid) is established/installed by the planning/gliding organizations.

2.7. During translation/conversion of work of boiler room from solid fuel to gaseous if necessary should be retained as another form of fuel/propellant solid. Use/application in this case of petroleum residue must be substantiated.

3. Furnace installations.

assertion of projects and estimates of boiler rooms are determined by "Command on development of standard designs for industrial construction" (SN 227-62) and by "command on development of designs and estimates for industrial construction" (SN 202-62).

2. Fuel/propellant.

2.1. Form of fuel/propellant for newly projected/designed and reconstructed boiler rooms is established/installed by planning/gliding organs/controls.

2.2. Design of boiler rooms with layer combustion of anthracites and lean coal whose delivery for layer combustion is not provided for by acting Gosts on carbon/coals or corresponding deposits, is not allowed/assumed in view of extremely large losses of fuel/propellant.

2.3. Taking into account coal layer combustion of high-moisture brown coal from Q_H^P 2500 kcal/kg and schists connected with large losses of fuel/propellant and complication of operation, use/application of these fuels/propellants can be permitted only as exception/elimination.

FOOTNOTE *. In the section "Combustion systems" the quantitative boiler output is conditionally shown on the pair (in t/h); the recommendations of present section also relate also to hot-waters boiler of equivalent heating power. ENDFOOTNOTE.

3.1. In heating and heating-production boiler rooms, which work with variable/alternating thermal load, is recommended, as a rule, layer combustion of fuel/propellant.

3.2. Selection of combustion systems, in depending on form of burned fuel/propellant and to productivity of boiler aggregate/unit, is recommended to manufacture:

for boilers by productivity from 2.5 t/h it is above with layer heatings - on tables 1;

for boilers with chamber furnaces - on Tables 2 and 3.

Note. The recommendations of the tables indicated do not eliminate the use/application of other combustion systems the advisability of setting up or which must be substantiated.

3.3. Combustion systems of boilers are accepted in accordance with plant layout.

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Table 1. Recommended types of the layer mechanized heatings.

(2) Вид топлива	(1) Паропроизводительность котла в т/ч				
	2,5—4	6,5	10	15—20	>20
(3) Антрацит АС и АМ	(4) Топки с пневмомеханическими забрасывателями и неподвижной решеткой		(5) Топки с цепной решеткой прямого хода		—
(6) Каменные угли	(7) Топки с пневмомеханическими разбрасывателями и неподвижной решеткой	(8) Топки с пневмомеханическими забрасывателями и цепной решеткой обратного хода			
(9) Каменные угли $V^r > 20\%$ $A^u < 5,7$		(9) Топки с пневмомеханическими забрасывателями и неподвижной решеткой[2]	(10) Топки с пневматическими забрасывателями и цепной решеткой прямого хода[2]		
(11) Бурые угли	(11) Топки с пневмомеханическими забрасывателями и неподвижной решеткой[1]	(12) Топки с пневмомеханическими забрасывателями и цепной решеткой обратного хода[1]			
	(13) Топки с шурующей планкой[2]	(14) Топки с пневмомеханическими забрасывателями и неподвижной решеткой[2]	(15) При $W_p < 30\%$ топки с пневматическими забрасывателями и цепной решеткой прямого хода[2]		
(16) Торф кусковой	(17) Шахтные топки		(18) Шахтно-цепная топка		
(19) Сланцы	(20) Топки с наклонно-переталкивающей решеткой				
(21) Древесные отходы W^p 50-55%	(22) Скоростная топка ЦКТИ системы Померанцева[1]				
	(23) Шахтная топка с наклонной решеткой[2]				

Note. Here and throughout of the text value A^u - the given ash content of fuel $\frac{\%}{(1)\ тыс \cdot ккал/кг}$.

K-y (1). thous•kcal/kg.

Key: (1). Boiler steam capacity in t/h. (2). Form of fuel/propellant. (3). Anthracite AS and AK. (4). Heatings with pneumomechanical spreaders and rigid lattice. (5). Heatings with chain grate of forward stroke. (6). Coals. (7). Heatings with pneumomechanical spreaders and by rigid lattice. (8). Heatings with pneumomechanical spreaders and chain grate or back stroke. (9). Heatings with pneumomechanical spreaders and fixed grid[2].

FOOTNOTE [2]. Replacing type of combustion system. ENDFOOTNOTE.

(10). Heatings with pneumatic spreaders and chain grate of forward stroke[2]. (11). Heatings with pneumomechanical spreaders and rigid lattice[1].

FOOTNOTE [1]. Recommended type of combustion system. ENDFOOTNOTE.

(12). Heatings with pneumomechanical spreaders and chain grate of back stroke[1]. (13). Brown coal. (14). Heatings with poking bar/plate[2]. (15). With $W_p \leq 30\%$ swamp with pneumatic spreaders and chain grate of forward stroke [2]. (16). Peat of cake. (17). Mine/shaft heatings. (18). Mine-chain heating. (19). Schists. (20). Heatings with obliquely pushing grate. (21). Wooden

withdrawals/departures. (22). High-speed/high-velocity heating of TsKTI system of Pomerantsev[1]. (23). Mine/shaft heating with inclined grate[2].

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Table 2. Recommended types of chamber furnaces for the solid fuel.

(1) Вид топлива	(2) Производительность котла в т/ч	(3) Тип топочного устройства
4. Каменные угли $V^r \geqslant 25\%$	$\geqslant 35$	5. Пылеугольные топки, оборудованные среднеходовыми или молотковыми мельницами с воздушно-проходными сепараторами
6. Бурые угли $W^r < 8\%$	$\geqslant 35$	7. Пылеугольные топки с мельницами молотковыми аксиальными (ММА) или мелющими вентиляторами
8. Фрезерный торф	2,5—20	9. Пневматические топки ЦКТИ системы Шершнева
10. То же	>20	11. Шахтно-мельничные топки
12. Сланцы прибалтийские	$\geqslant 35$	10. То же

Notes: 1. Under the pulverized-coal combustors are understood the heatings, equipped by pulverized coal burners, including with the grinding of fuel/propellant in the hammer mills.

2. Mine-mill are named heatings, equipped with open embrasures with different breakwaters.

3. During alternating combustion of dust, gas or petroleum residue are applied multifuel burners.

Key: (1). Form of fuel/propellant. (2). Quantitative boiler output in m/h. (3). Type of combustion system. (4). Coals. (5). Pulverized-coal combustors, equipped with medium-stroke or hammer mills with

air-passage separators. (6). Lignite carbon/coals. (7). Pulverized-coal combustors with mills by hammer axial (MMA) or grinding fans. (8). Milling peat. (9). Pneumatic heatings of TsKTI system of Shershnev. (10). The same. (11). Mine-mill heatings. (12). Schists (Baltic.

Table 3. Recommended types of burners for combusting of petroleum residue and natural gas.

(1) Вид топлива	(2) Производительность котла в т/ч или тип котла	(3) Типы горелочных устройств	
		(4) рекомендуемые	(5) заменяющие
(6) Природный газ	2,5—10	(7) Счесительные низкого давления	(8) Подовые низкого и среднего давления с принудительной подачей воздуха (9) Вертикально-щелевые
(10) То же	>10	(11) То же	(12) Вертикально-щелевые[1]
(13) Мазут	2,5—10	(14) Паромеханические форсунки (15) Ротационные форсунки[2]	(16) Низконапорные форсунки воздушного распиливания
»	>10	(17) То же	(18) Механические форсунки[3]
(19) Природный газ	(20) Чугунный секционный	(21) Форкамерные низкого и среднего давления (чугунные литые)	(22) Форкамерные низкого и среднего давления (стальные сварные)
(23) То же	(24) Вертикально-цилиндрический	(25) Подовые низкого давления бездутьевые	(26) Инжекционные среднего давления. Форкамерные и подовые многощелевые низкого давления
(27) Мазут	(28) Чугунный секционный	(29) Ротационные форсунки	(30) Низконапорные форсунки воздушного распиливания
»	(31) Вертикально-цилиндрический	(32) То же	(33) Низконапорные форсунки воздушного распиливания. Паромеханические форсунки

Notes: 1. During the variable/alterrating combustion of gas and petroleum residue are applied the combined gas-oil burners.

2. Recommendations regarding burner devices for cast iron sectional and vertical-cylindrical boilers are given with their heating power not more than 1 gcal/h.

Key: (1). Form of fuel/propellant. (2). Quantitative boiler output in m/h or type of boiler. (3). Types of burner devices. (4). recommended. (5). replacing. (6). Natural gas. (7). Low-pressure mixing. (8). Hearth of low and mean pressure with forced air supply. (9). vertical-slotted. (10). Ibid. (11). vertical-slotted[1].

FOOTNOTE [1]. They are applied if necessary of retaining/preserving/maintaining the work of boiler on solid fuel. ENDFOOTNOTE.

(12). Petroleum residue. (13). Steam-mechanical injectors. (14). Low-pressure injectors of air atomization. (15). Rotational injectors[2].

FOOTNOTE [2]. Injectors of this type by productivity more than 150 kg/h require developments and series mastery/adoption. ENDFOOTNOTE.

(16). Mechanical burners[3].

FOOTNOTE [3]. With small range of change in the loads of boiler or with the possibility of the disconnection of the part of the burners. ENDFOOTNOTE.

(17). Cast iron sectional. (18). Precombustion-chamber of low and mean pressure (cast iron cast). (19). Precombustion-chamber of low and mean pressure (steel welded). (20). Vertically cylindrical. (21). Low-pressure hearth blast-less. (22). Injection of mean pressure. Precombustion-chamber and hearth low-pressure multislot. (23). Cast iron sectional. (24). Rotational injectors. (25). Low-pressure injectors of air atomization. (26). vertical-cylindrical. (27). Low-pressure injectors of air atomization. Steam-mechanical injectors.

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3.4. Selection of structural/design sizes/dimensions of heatings is manufactured on the basis of thermal designs of boiler aggregates/units.

3.5. Volume of heating and area of mirror of combustion are determined on the basis of calculated (maximally prolonged) thermal load of boiler units.

3.6. Standard values of design characteristics of combustion systems for different forms of burned fuel/propellant are given:

for layer heatings with manual throw/excess/overshoot of fuel/propellant to rigid lattice - in Table 4-6.

for the layer mechanical and semimechanical heating - in Table 5-7;

for the chamber furnaces - in Tables 5, 6 and 8.

Table 4. Design characteristics of layer heatings with fixed grid and manual throw/excess/overshoot of fuel/propellant.

(1) Наименование показателей	(2) Обозначение	(3) Единица измерения	Донецкий антрацит АС, АМ, АК; A^p=...	Каменные (4) типа кузнецких Д и Г; A^p=1,4	типа донецких Д и Г; A^p=3,2	Бурые (5) типа артемовских W^r=7,4; A^p=4,2	типа ангренского W^r=8,4; A^p=6,5
(11) Видимое теплонапряжение зеркала горения	$\frac{BQ^p_н}{R}$	(12) тыс. ккал/м²·ч	700	700	700	700	700
(13) Допустимое теплонапряжение топочного объема	$\frac{BQ^p_н}{V_т}$	(14) тыс. ккал/м³·ч	250 — 350				
(15) Коэффициент избытка воздуха в топке	$\alpha_т$	—	1,8	1,6	1,6	1,6	1,6
(16) Потеря от химической неполноты сгорания	q_3	%	1	2	2	2	2
(17) Потеря тепла со шлаком	$q_4^{шл}$	%	6	3	5	5	7
(18) Потеря тепла с уносом	$q_4^{ун}$	%	5	1	1	1	1
(19) Потеря тепла от механического недожога	q_4	%	11	4	6	6	8
(20) Содержание горючих в шлаке	$г_{шл}$	%	29	23	18	14	13
(21) Содержание горючих в уносе	$г_{ун}$	%	76	54	35	20	19
(22) Доля золы топлива в уносе	$а_{ун}$	%	10	7	6	7	5,5
(23) Давление воздуха под решеткой	$P_д$	(24) мм вод. ст.	100	80	80	80	80

Note: 1. Design characteristics of layer heatings with the rigid lattice are given on given by IsKTI im. Polzunov.

2. Combustion of caking coal in heatings with manual maintenance/servicing is not recommended.

3. Design characteristics are given for heatings with rigid lattices without tiltable grate bars.

4. During use/application of heatings with rocking or tiltable grate bars value of thermal stress of mirror of combustion increases by 10-15o/o, respectively are changed heat losses.

5. Temperature of air for blasting is received as 25°C.

6. Calculated characteristis should not be applied to heatings of cast iron sectional and vertical-cylindrical boilers.

7. A^{p} and W^{p} - given ash content and humidity of fuel/propellant into o/o.

Key: (1). Designation of indices. (2). Designation. (3). Unit measurement. (4). Stoneware. (5). Brown. (6). Donets anthracite. (7). type Kuznetsk D and G. (8). type donets D and G. (9). Type Artemovskikh. (10). Type Yesselovskiy. (11). Seen thermal stress of mirror of combustion. (12). thousand of kcal/m²•h. (13). Permitted thermal stress of furnace cavity. (14). thousand of kkal/m³•h. (15). Excess air ratio in heating. (16). Loss from

chemical incompleteness of combustion. (17). Heat loss with slag. (18). Heat loss with escape. (19). Heat loss from mechanical incomplete burning. (20). Content of fuels in slag. (21). Content of fuels in escape. (22). Share or ash of fuel/propellant in escape. (23). Air pressure under grate. (24). mm. water column.

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Table 5. Design characteristics of the heatings of cast-iron sectional boilers.

(1) Наименование показателей	(2) Обозначение	(3) Единица измерения	(4) Ручные топки с неподвижными решетками и опрокидными колосниками		(5) Шахтная топка с наклонными неподвижными колосниками	(6) Топка скоростного горения ЦКТИ системы Померанцева	(7) Камерные топки	
			(8) Сортированный уголь		(11) кусковой торф W^P > 40%; A^C = 10%	(12) дробленые древесные отходы W^P = 40 ÷ ÷ 60%	(13) мазут	(14) природный газ
			(9) типа подмосковного бурого A^H=8	(10) антрациты, АК, АС и АМ; A^H = 2				
(15) Видимое теплонапряжение зеркала горения	$\frac{BQ^P_H}{R}$	(16) тыс. ккал/м²·ч	—	—	500	4000	—	—
(17) Видимое тепловое напряжение топочного объема	$\frac{BQ^P_H}{V_T}$	(18) тыс. ккал/м³·ч	—	—	250—300	350—450	—	—
(19) Коэффициент избытка воздуха в топке	α_T	—	1,6—1,8	1,4—1,6	1,3—1,4	1,25—1,35	1,07—1,2	1,08—1,15
(20) Потеря от химической неполноты сгорания	q_3	%	3	2,3	3	5—6	0—1	0—0,6
(21) Потери от механической неполноты сгорания	q_4	(23) %	9,5	3—10	2,5	5,6	—	—
(22) Давление воздуха под решеткой	P_1	мм вод. ст.	60—80	40—60	60	100—120	—	—

Notes: 1. The temperature of air for the blasting is received as 25°C.

2. Design characteristics of heatings are accepted according to data of NIIST.

Key: (1). Designation of indices. (2). Designation. (3). Unit measurement. (4). Manual heatings with rigid lattices and tiltable grate bars. (5). Mine/shaft heating with inclined dead bars. (6).

Heating of high-speed/high-velocity combustion of TsKTI system of Pomerantsev. (7). Chamber furnaces. (8). Screened. carbon/coal. (9). type of Moscow brown. (10). anthracite, AK, AS and AM. (11). cake peat. (12). crushed wood withdrawals/departures. (13). petroleum residue. (14). natural gas. (15). Seen thermal stress of mirror of combustion. (16). thousand cr kcal/m^2•h. (17). Visible thermal stress of furnace cavity. (18). thousand of kkal/m^3•h. (19). Excess air ratio in heating. (20). Loss from chemical incompleteness of combustion. (21). Losses from mechanical incompleteness of combustion. (22). Pressure of air under grate. (23). mm. water column.

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Table 6. Design characteristics of the heatings of vertically barrel boilers.

(1) Наименование показателей	(2) Обозначение	(3) Единица измерения	(4) Ручные внутренние топки с неподвижными решетками и опрокидными колосниками		(5) Камерные топки	
			(6) грохоченые каменные угли $V^r \leq 25\%$; $A^u \leq 4$	(7) грохоченые антрациты АС и АМ; $A^u \leq 2$	(8) мазут	(9) природный газ
(10) Видимое теплонапряжение зеркала горения	$\frac{BQ_н^р}{R}$	(11) тыс. ккал/м² ч	400—600		—	—
(12) Видимое теплонапряжение топочного объема	$\frac{BQ_н^р}{V_т}$	(13) тыс ккал/м³ ч	300—600		300—600	
(14) Коэффициент избытка воздуха в топке	$\alpha_т$	—	1,4—1,6		1,15—1,2	
(15) Потеря от химической неполноты сгорания	q_3	%	3—5		1—1,5	0—0,6
(16) Потеря от механической неполноты сгорания	q_4	%	8—10		—	—
(17) Давление воздуха под решеткой	$P_в$	(18) мм вод. ст.	80	100	—	—

Notes: 1. Design characteristics of internal heatings are given cn given by TsKTI im. Polzunov.

2. During combustion of petroleum residue and natural gas in internal heating of value $\frac{BQ_н^р}{V_т}$ it can be accepted by 800 thousand

kcal/m³•h.

3. Temperature of air for blasting is received as 25°C.

4. In the case of applying dutch-oven furnaces natures to acquire on Tables 1 and 4.

Key: (1). Designation of indices. (2). Designation. (3). Unit of measurement. (4). Manual internal heatings with rigid lattice mi and tiltable grate bars. (5). Chamber furnaces. (6). Screened stone coals. (7). Screened anthracite AS and AM. (8). petroleum residue. (9). natural gas. (10). Seen thermal stress of mirror of combustion. (11). thousand of kcal/m²•h. (12). Seen thermal stress of furnace cavity. (13). thousand kcal/m³•h. (14). Excess air ratio in heating. (15). Loss from chemical incompleteness of combustion. (16). Loss from mechanical incompleteness of combustion. (17). Air pressure under grate. (18). mm. water column.

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Table 7. Design characteristics of the layer mechanized heatings.

(1) Наименование показателей	(2) Обозначение	(3) Единица измерения	(4) Топки с цепной решеткой	(5) Шахтно-цепные топки	(6) Топки с пневматическими забрасывателями и цепной решетки прямого хода			
					(7) Каменные угли[3]		(8) Бурые угли	
			(9) донецкий антрацит АС, АМ: $A^п = 2$	(10) торф кусковой $W^р = 45 \div 50\%$, $A^с = 3$	(11) типа кузнецких Д и Г: $A^п = 1,4$	(12) типа донецких Д и Г: $A^п = 3,2$	(13) типа артемовского $W^п = 7,4$; $A^п = 4,2$	(14) типа весьеловского $W^п = 8,4$; $A^п = 6,6$
(15) Видимое теплонапряжение зеркала горения	$\frac{BQ^р_н}{R}$	(16) тыс. ккал / м²·ч	1000	1500—1900[4]	1000	1000	1400	1400
(17) Видимое теплонапряжение топочного объема	$\frac{BQ^р_н}{V_т}$	(18) тыс. ккал / м³·ч				250—400		
(19) Коэффициент избытка воздуха в топке[1]	$\alpha_т$	—	1,5—1,6	1,3	1,4—1,5	1,4—1,5	1,3—1,4	1,3—1,4
(20) Доля золы топлива в уносе	$a_{ун}$	%	10	—	20	16	19	15
(21) Потеря от химической неполноты сгорания	q_3	%	0,5	1	0,5	0,5	0,5	0,5
(22) Потеря со шлаком	$q_{4\,шл}$	%	5	—	1,5	2,5	3	4
(23) Потеря с уносом[2]	$q_{4\,ун}$	%	8,5	—	4,5	3,5	2,5	3
(24) Суммарная потеря от механической неполноты сгорания	q_4	(25) %	13,5	2	6	6	5,5	7
(26) Давление воздуха под решеткой	$P_д$	мм вод. ст.	100	100	80	80	80	80
(27) Температура дутьевого воздуха	$t_в$	°С	25 или 150—200	250	25 или 150—200	25 или 150—200	200—250	200—250

Continuation of Table 7.

(1) Наименование показателей	(2) Обозначение	(3) Единица измерения	(6) Топки с пневматическими забрасывателями и цепной решеткой обратного хода								
			(7) Каменные угли				(8) Бурые угли				
			типа кузнецких Д и Г; (11) $A^{II} = 1,4$	типа донецких Д и Г; (12) $A^{II} = 3,2$	типа сучанского (13) $A^{II} = 5,7$	типа кузнецкого ГСС; (14) $A^{II} = 1,60$	типа ирша-бородинского (30) $W^{II} = 8,8$; $A^{II} = 4,6$	типа артемовского (31) $W^{II} = 7,4$; $A^{II} = 4,2$	типа весловского (32) $W^{II} = 8,4$; $A^{II} = 6,5$	типа хиамовского (33) $W^{II} = 13,6$; $A^{II} = 2,9$	типа подмосковного (34) $W^{II} = 12,4$; $A^{II} = 8,9$
(15) Видимое теплонапряжение зеркала горения	$\frac{BQ_н^р}{R}$	(16) тыс. ккал / м²·ч	1400	1400	1300	1400	1400	1400	1400	1400	1400
(17) Видимое теплонапряжение топочного объема	$\frac{BQ_н^р}{V_т}$	(18) тыс. ккал / м³·ч	250—400								
(19) Коэффициент избытка воздуха в топке[1]	$\alpha_т$	—	1,3—1,4	1,3—1,4	1,3—1,4	1,3—1,4	1,3—1,4	1,3—1,4	1,3—1,4	1,3—1,4	1,3—1,4
(20) Доля золы топлива в уносе	$a_{ун}$	%	20	16	11	20	27	19	15	19	11
(21) Потеря от химической неполноты сгорания	q_3	%	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
(22) Потеря со шлаком	$q_4^{шл}$	%	1,5	2,5	4,5	2	1	3	4	2	5
(23) Потеря с уносом[2]	$q_4^{ун}$	%	4,5	3,5	3	10	5	2,5	3	4,5	3
(24) Суммарная потеря от механической неполноты сгорания	q_4	%	6	6	7,5	12	6	5,5	7	6,5	8
(25) Давление воздуха под решеткой	$P_р$	(26) мм вод. ст.	50 (27)	50 (27)	50 (27)	50 (27)	50	50	50	50	50
(28) Температура дутьевого воздуха	$t_в$	°C	25 или 150—200	25 или 150—200	25 или 150—200	25 или 150—200	150—250	150—250	150—250	150—250	150—250

Continuation Table 7.

(1) Наименование показателей	(2) Обозначение	(3) Единица измерения	(6) Топки с пневматическими забрасывателями и неподвижной решеткой								
			(7) Каменные угли				(8) Бурые угли				
			донецкий антрацит АМ и АС; $A^{п} \leq 2$ (35)	типа кузнецких Д и Г; $A^{п} = 1,4$ (11)	типа донецкого Д и Г; $A^{п} = 3,2$; (36)	типа кузнецкого ГСС; $A^{п} = 1,60$ (34)	типа приаральского $W^{п} = 8,8$; $A^{п} = 1,6$ (30)	типа артемовского $W^{п} = 7,4$; $A^{п} = 4,2$ (31)	типа вессловского $W^{п} = 8,4$; $A^{п} = 6,5$ (32)	типа хоринорского $W^{п} = 13,6$; $A^{п} = 2,9$ (33)	типа подмосковного $W^{п} = 12,8$; $A^{п} = 8,9$ (34)
(15) Видимое теплонапряжение зеркала горения	$\frac{BQ_{н}^{р}}{R}$	(16) тыс. ккал/м²·ч	1000	900	900	900	900	900	900	900	800
(17) Видимое теплонапряжение топочного объема	$\frac{BQ_{н}^{р}}{V_{т}}$	(18) тыс. ккал/м³·ч	250—400								
(19) Коэффициент избытка воздуха в топке[1]	$\alpha_{т}$	—	1,6—1,7	1,4—1,5	1,4—1,5	1,4—1,5	1,4—1,5	1,4—1,5	1,4—1,5	1,4—1,5	1,4—1,5
(20) Доля золы топлива в уносе	$a_{ун}$	%	10	16	13	16	22	15	12	15	10
(21) Потеря от химической неполноты сгорания	q_{3}	%	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
(22) Потеря со шлаком	$q_{4}^{шл}$	%	5	2	3	2,5	1,5	3,5	5,5	3,5	7
(23) Потеря с уносом[2]	$q_{4}^{ун}$	%	8,5	3,5	3,5	8	4	2	2,5	3,5	3
(24) Суммарная потеря от механической неполноты сгорания	q_{4}	(25) %	13,5	5,5	6,5	10,5	5,5	5,5	8	6,5	10
(25) Давление воздуха под решеткой	$P_{р}$	мм вод. ст	100 (9)	80 (27)	80 (10)	80 (37)	80 (28)	80 (29)	80 (27)	80 (27)	90 (27)
(26) Температура дутьевого воздуха	$t_{в}$	°С	25 или 150—200	25 или 150—200	25 или 150—200	25 или 150—200	25 или 150—200	25 или 150—200	25 или 150—200	25 или 150—200	25 или 150—200

Continuation of Table 7.

(1) Наименование показателей	(2) Обозначение	(3) Единица измерения	Шахтные топки с наклонной решеткой (7) (4)		Топки скоростного горения (5) (6)		(8) Топки с наклонными переталкивающими решетками (4) (5)
			(10) тощий кусковой $W^p = 40\%$; $A^p = 2,6$	(10) (9) древесные отходы $W^p = 50\%$	(11) рубленая щепа $W^p = 40-50\%$	(12) трубчатые отходы опилки $W^p = 40-50\%$	(13) эстонские сланцы $W^p = 5$; $A^p = 21$
(14) Видимое теплонапряжение зеркала горения	$\frac{BQ^p_н}{R}$	(16) тыс. ккал / м²·ч	1100	500	5000—6000	2000—4000	900
(17) Видимое теплонапряжение топочного объема	$\frac{BQ^p_н}{V_т}$	(18) тыс.ккал / м³·ч	200—250		250—400		200—250
(19) Коэффициент избытка воздуха в топке[1]	$\alpha_т$	—	1,4	1,4	1,2	1,3	1,4
(20) Доля золы топлива в уносе	$a_{ун}$	%	—	—	—	—	—
(21) Потеря от химической неполноты сгорания	q_3	%	2	2	1	1	3
(22) Потеря со шлаком	$q_4^{шл}$	%	1	—	—	—	2
(23) Потеря с уносом[2]	$q_4^{ун}$	%	1	2	2	2	1
(24) Суммарная потеря от механической неполноты сгорания	q_4	(25) %	2	2	2	2	3
(25) Давление воздуха под решеткой	$P^p_в$	мм вод. ст.	60	80	70	100	60
(26) Температура дутьевого воздуха	$t_в$	°C	200—250	200—250	200—250	200—250	25 или (27) 150—200

Notes: 1. For the boilers with steam productivity of up to 10 t/h, equipped by heatings with the pneumatic spreaders and chain grate of back stroke, the temperature of blast air is allowed/assumed by 25°C.

2. Tabular values of thermal stresses of grate relate to mode/conditions of work of combustion system with maximum efficiency of boiler. Is possible a prolonged increase in the thermal loads on 20%.

Key: (1). Designation of indices. (2). Designation. (3). Unit measurement. (4). Heatings with chain/catenary grate. (5). Mine-chain heatings. (6). Heatings with pneumatic spreaders and chain grate of

forward stroke. (7). Coals[4].

FOOTNOTE [3]. The combustion of coals with the low-melting ash in the heatings of this type is not recommended. ENDFOOTNOTE.

(8). Brown coal. (9) Donets anthracite. (10). peat of cake. (11). type Kuznetsk D and G. (12). type donets D and G. (13). type Artemovskiy. (14). type Veselovskiy. (15). Seen thermal stress of mirror of combustion. (16). thousand of kcal/m^2•h. (17). Seen thermal stress of furnace cavity. (18). thousand of kkal/m^3•h. (19). Excess air ratio in heating[1].

FOOTNOTE [1]. Smaller value for boilers D>10 t/h. ENDFOOTNOTE.

(20). Share of ash of fuel/propellant in escape. (21). Loss from chemical incompleteness of combustion. (22). Loss with slag. (23). Loss with escape[2].

FOOTNOTE [2]. The value of losses with the escape in the cases of combusting rock and brown coal is given for the series fuel/propellant with the content of the dust particles of 0-0.69 mm - 2.5g/g in the absence of the return of escape and sharp/acute blasting. For Kuznetsk carbon/coal GSS the content of dust particles is accepted by 5g/g. In general loss with the escape is changed

directly proportional to the content of dust particles in the fuel/propellant. When the return of escape and sharp/acute blasting is present, the loss with the escape is decreased 2-3 times. ENDFOOTNOTE.

(24). Total loss from mechanical incompleteness of combustion. (25). Air pressure under grate. (25a). mm. water column. (26). Temperature of blasted air. (27). or. (28). type Suchansk. (29). type Kuznetsk. (30). type Irsha-Borodino. (31). type of Artemovskiy. (32). type Veselovskiy. (33). type Khoranorskiy. (34). type Moscow. (35). donets anthracite AM and AS. (36). Type Donets D and G. (37). Mine/shaft heatings with inclined grate. (38). Heatings of high-speed/high-velocity combustion. (39). Heatings with inclined tiltable grates. (40). wood withdrawals/departures. (41). chopped chips. (42). crushed withdrawals/departures and filings. (43). Estonian schists.

FOOTNOTE *. Smaller value for boilers D>20 t/h.

*. Smaller value for boilers D>10 t/h; as reference area of mirror it is accepted area of open part of pressing grate. ENDFOOTNOTE.

3.7. For exception/elimination of slagging convective surfaces of heating boilers of temperature of gases at output/yield from chamber furnaces (with rated steam capacity of boiler) it should be taken as equal to mean temperatures of beginning of strain of ash t_1=910-1150°C.

For the non-slagging solid fuels with the high-melting ash the temperature of gases at the output/yield from the heating must be accepted on the basis of the corresponding technical and economic calculations.

Table 8. Design characteristics of chamber furnaces for the boilers by productivity are 15 t/h and are above.

(1) Топка	(2) Вид топлива	(3) Коэффициенты избытка воздуха в топке, $\alpha_т$	(4) Допустимое тепловое напряжение топочного объема $\frac{BQ_н^р}{V_т}$ в тыс.ккал/м³·ч	(5) Потери тепла q_3+q_4 в %
(6) Пылеугольная	(7) Каменные угли[1] $V^r > 25\%$	1,25	140—190	0,5—2,5
	(8) Бурые угли[1]	1,25	150—200	0,5—1
	(9) Сланцы эстонские	1,25	120—160	0,5—1,5
	(10) Фрезерный торф	1,25	150—200	0,5—1,5
(11) Пневматическая ЦКТИ системы (13) Шершнева	(12) Фрезерный торф	1,25—(1,4)[2]	120 (до 300)[2]	0,5—6
(14) Камерная	(15) Мазут, газ	1,1—1,15	400—1000	0,5—1

Note. The selection of value $\frac{BQ_н^р}{V_т}$ depends on total hours of utilization of setting up, grade of load and configuration of heating. In this case the larger value of the thermal stress of furnace cavity is accepted for the boiler with smaller total hours of utilization of installed capacity (≤ 1500 h per annum), and also during the reconstruction of boiler units.

Key: (1). Heating. (2). Form of fuel/propellant. (3). Excess air ratios in heating. (4). Permitted thermal stress of furnace cavity $\frac{BQ_н^р}{V_т}$ in thousand of kkal/m³·h. (5). Losses of heat q_3+q_4 in %. (6). Pulverized coal. (7). Coals[1] V^r >25%.

FOOTNOTE 1. With dry slag-ash removal. ENDFOOTNOTE.

(8). Brown coal[1].

(9). Schists (Estonian. (10). Milling peat. (11). Pneumatic of TsKTI system. (12). Milling peat. (13). Shershneva. (14). Chamber. (15). Petroleum residue, gas.

FOOTNOTE 2. The values or the values, given in the brackets, are given for two-chamber type heatings. ENDFOOTNOTE.

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For the fuels/propellants for which according to experimental data the permissible temperatures of gases at the output/yield from the heating differ significantly from mean temperatures of the beginning of the strain of ash, the temperature of gases at the output/yield from the heating one should accept on Table 9.

Table 9. Permissible temperatures of gases at the output/yield from the heating.

(1) Топливо	(2) Температура газов в °С
(3)Антрацитовый штыб АШ, полуантрациты ПА и тощие угли Т	1150
(4)Кизеловские угли (Г и отсевы)	1100
(5)Кизеловский промпродукт ПП	1050
(6)Подмосковный уголь Б	1100
(7)Богословский и веселовский угли (Б)	1150
(8)Ангренский уголь Б	900
(9)Канско-ачинские угли Б (ирша-бородинские, назаровские, итатские, боготольские)	900
(10)Сланцы эстонские, гдовские и волжские	950
(11)Фрезерный торф	1000

Key: (1). Fuel/propellant. (2). Temperature of gases in °C. (3). Anthracite fines ASh, carbonaceous coal Pa and lean coal T. (4). Kizelovskiy carbon/coals (G and screenings). (5). Kizelovskiy semi-finished product PP. (6). Moscow carbon/coal B. (7). Theological and Veselovskiy carbon/coals (B). (8). Angren carbon/coal B. (9). Kansk-Achinsk carbon/coals B (Irsha-Borodino, Nazarovsk, Itatsk, Bogotol'skiy). (10). Schists Estonian, Gdovsk and Volga. (11). Milling peat.

4. Boilers and "tail" heating surfaces.

Boilers.

Hot-waters boiler.

4.1. As hot-waters boiler it should be accepted;

for heating of water to temperature of 115°C - cast iron sectional boilers, produced by industry;

for heating of water to temperature of 200°C - steel hot-waters boiler, produced by industry.

Note. Cast iron sectional boilers with the equipment by their steam collectors can be used as the steam ones from the pressures of steam not more than 0.7 atm(gage).

4.2. Types and basic parameters of cast iron sectional boilers heating surface of more than 4 m² with heatings for combusting solid fuel should be accepted according to data of GOST [All-union State Standard] 10617-63 "Boilers heating cast iron with heatings for combusting solid fuel".

Heat productivity of these boilers during the combustion of different forms of fuel/propellant is accepted according to the specifications of manufacturing plant.

4.3. Combustion of high-ash and high-moisture brown coal with heat of combustion of $Q_н^р$ 2800 kcal/kg, and also schists, peat and

other forms of fuel/propellant with content $S^{n} \geqslant 0{,}2 \cdot 10^{3}\%$ kg/kcal for boiler rooms with steel hot-waters boiler is not recommended.

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In order to avoid or the corrosion of the surfaces of heating steel hot-waters boiler should be provided for the measures, which ensure the temperature of water at the entrance into the boiler higher than the dew point for the burned form of fuel/propellant.

Steel hot-waters boiler with the temperature of heating water to 200°C, in proportion to mastery/adoption by their industry, should be accepted in the projects in accordance with the scale of typical dimensions, given in Table 10[1].

FOOTNOTE [1]. Is affirmed by the former state committee of heavy, power and transport machine-building under the Gosplan of the USSR on 25 June, 1965. ENDFOOTNOTE.

Table 10. Extraction from the scale of the typical dimensions of steel hot-waters boiler.

(1) Теплопроизводительность котла в Гкал/ч	(2) Давление воды на входе в котел в кг/см²	(3) Температура воды за котлом в °С до
50	25	200
30	25	200
20	25	200
10	25	200
6,5	16	150
4	16	150

Key: (1). Heating power of boiler in gcal/h. (2). Pressure of water at entrance into boiler in kg/cm². (3). Temperature of water after boiler in °C to.

Steam boilers.

4.4. During design of boiler rooms, as a rule, should be applied steam boilers, serially produced by industry.

4.5. Nominal values of boiler steam capacity and temperature of steam indicated in GOST 3619-59 "Boilers steam stationary. The types and the basic parameters", must be provided at the combustion of the fuel/propellant, accepted during the construction of boiler.

With the delivery of these boilers for the work on the reduced pressure of steam, and also at the values of the temperatures of steam and feed water, that differ from the accepted for the rated steam capacity boilers, the corresponding coefficient of evaporation is established/installed by calculation and is coordinated with the plant - the producer of boilers.

4.6. Quantitative boiler output, calculated for work on solid fuel, during their translation/conversion into combustion of gas or petroleum residue can be increased.

An increase in the quantitative boiler output must be substantiated by calculation and it is matched with the manufacturing plant.

4.7. During design of boiler rooms one should proceed from conditions of complete and block delivery of boiler units, switching on combustion systems, tail heating surfaces, forced-draft installations, ash catchers, KIP, automation, etc. A trouble-free operation of boiler unit, its productivity and efficiency must be guaranteed by supplier.

4.8. During design of boiler rooms with boilers, serially produced by industry, thermal designs of latter are not manufactured. The boiler operating parameters are taken from the manufactuer's data.

The thermal designs of boiler units during their reconstruction are fulfilled in accordance with the indications of the standard method of the thermal design of boiler aggregates/units.

Tail heating surfaces.

4.9. Tail heating surfaces - air preheaters and feed-water economizers should be established/installed all boilers coefficient of evaporation 2.5 t/h and more at temperature of gases after boilers of more than 250°C.

The installation of boilers by the productivity of less than 2.5

t/h without the tail heating surface at temperature of gases after the boiler of more than 250°C must be substantiated.

Note. For the boilers of the type DKVR if the product of the cost/value of 1 t of reference fuel (in rub) to the annual total hours of utilization of installed capacity the boiler less than 10000, is allowed/assumed the installation of these boilers without the tail heating surfaces.

4.10. In boiler rooms must be used cast iron or steel feed-water economizers.

Air preheaters should be applied in cases when preheating air necessary for intensification and stability of the process of combustion, drying of fuel/propellant or increase in the efficiency/cost-effectiveness of the work of heating.

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For more in-depth use of heat of stack gases one should provide for the use/application of the combined tail surfaces of heating (in the combination of water cast iron economizer with the air preheater or with the steel tubular economizer).

4.11. During layer combustion of all forms of carbon/coals for boilers by coefficient of evaporation 20 t/h and above should be applied combined tail heating surfaces, which consist of water cast iron economizer and air preheater.

4.12. Tail heating surfaces are established/installed directly behind boiler, before ash catcher and exhaust fan.

4.13. Installation of tail heating surfaces, general/common/total for all or group of boilers, is allowed/assumed in boiler rooms with boilers by productivity of less than 2.5 t/h or during reconstruction of boiler rooms.

4.14. Connection of tail heating surfaces into gas circuit must eliminate use/application of gas bypasses and bypasses.

Gas bypasses should be applied during the installation of the group heating surfaces. In this case on the gas bypasses must be established/installed consecutively/serially two dense dampers or two shutters/valves.

4.15. Feed-water economizers will be used for heating both feed water of boilers and of network.

The installation of economizer with the switching from heating of feed water to heating of network water is not recommended.

4.16. Gas velocity in cast iron economizer with maximum (calculated) load of boiler is recommended the accepting of 7-10 m/s.

4.17. Inclusion/connection of economizer of feed water must provide for direction of flow of water from bottom to top.

The motion of water and gases, as a rule, must be countercurrent.

4.18. With two-core economizers of feed water cold water is fed into second on course of gases column; motion of feed water is accomplished/realized from bottom to top in both columns of economizer.

In the economizers of network water the direction of the motion of water can be both from bottom to top and downward.

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4.19. When selecting of temperature of stack gases economizer of feed water one should approach optimum value of difference between

temperatures of gases at output/yield and of water at entrance into economizer ($\Delta t_{хк}$ - difference in temperatures of "cold" end).

Optimum values $\Delta t_{хк}$ with the countercurrent comprise:

for the boiler with the product of annual total hours of utilization to the cost/value of 1 t of reference fuel (in rub) are more than 2500 $\Delta t_{хк} = 30 \div 50°C$;

for the boiler with the product of annual total hours of utilization to the cost/value of 1 t of reference fuel (in rub) 25 000—10 000 $\Delta t_{хк} = 50 \div 80°C$.

The temperature of stack gases after the economizers of feed water must be not below: for the dry low-ash fuel/propellant - 120°C; for the remaining forms of fuel/propellant - 140°C and sulfurous petroleum residue - 160°C.

4.20. During determination of surface of heating feed-water economizer temperature of feed water at output/yield from group economizer and economizers of old constructions/designs (TsKKE, Green, etc.) should be accepted not less than on 40°C lower temperatures of saturation, but at output/yield from individual (from ducts of construction/design VTI) - on 20°C.

4.21. The upper collector/receptacle of water "undetachable" economizer (on water and gases) must be arranged below center of boiler barrel for guaranteeing free diversion/tap of steam-water emulsion from economizer into drum.

4.22. In upper flue of economizer must be provided for access for cleaning of ducts from pollution/contamination, and for boilers, intended for work on coal dust, gas or petroleum residue, also rupture disks.

4.23. Feed-water economizers must be equipped with devices for periodic surface cleaning or heating.

4.24. As the first on course of gases of step/stage of combined tail surfaces of heating, and also basic tail heating surface during combustion of high-moisture nonsulfur fuels/propellants ($S^p \leq 0{,}2\%$) one should apply steel tubular air preheaters.

During the combustion of high-moisture and high-sulphur fuel is allowed/assumed the use/application of cast iron air preheaters from finned-serrated ducts.

4.25. Gas velocity in air preheater at rated load is recommended to accept:

for steel tubular air preheater - 10-12 m/s;

for cast iron finned-serrated air preheater - 13-15 m/s.

4.26. Ratio of air speed to gas velocity for different air preheaters is recommended to accept:

for steel tube of compressed air preheater - 0.5;

for cast iron finned-serrated air preheater - 0.7.

4.27. Temperature of air at the inlet into air preheater, for the purpose of prevention or clogging by ash of heating surface, should be accepted on 5-10°C above temperatures of condensation of water vapors of flue gases.

For the solid fuels to this condition correspond the temperature of airs at the inlet into the air preheater, given in Table 11.

4.28. Temperatures of stack gases after air preheater select on the basis of optimum value of difference between temperature of gases at entrance and air at output/yield from air preheater ($\Delta t_{г.к}$ - difference in temperatures of "hot" end).

Optimum values $\Delta t_{г.к}$ comprise:

for the boiler with the product of annual total hours of utilization to the cost/value of 1 t of reference fuel (in rub) are more 25000 $\Delta t_{г.к}$ = 35÷70°C;

for the boiler with the product of annual total hours of utilization to the cost/value of 1 t of reference fuel (in rub) 25000 ÷ 10000 $\Delta t_{г.к}$ = 70 ÷ 140°C.

If after the air preheater the temperature of gases is higher than 220°C, then after it should be established/installed water saver.

Table 11. Temperature of air at the inlet into the air preheater.

(1) Топливо	(2) Температура воздуха на входе в воздухоподогреватель в °С
(3) Сухое при $W^{п}$ 2%	30
(4) Влажное при $W^{п}$ 5÷20%	50—60
(5) Сильно влажное при $W^{п}$ 25%	65

Note. During the combustion of sulfurous fuel the temperature of air at the entrance into the air preheater due to the presence of sulfur it is accepted without taking into account an increase in the dewpoint.

Key: (1). Fuel/propellant. (2). Temperature of air at the inlet into air preheater in °C. (3). Dry with. (4). Humid with. (5). Strongly humid with.

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5. Forced-draft installations, gas-air pipes and chimney stacks.

5.1. Forced-draft installations are accepted in accordance with plant delivery of boiler units.

5.2. Planning gas-air duct of boiler rooms (determination of resistance, construction/design of gas-air lines, etc.) is fulfilled in accordance with indications or standard method of aerodynamic design of boiler installations.

5.3. Gas resistance of serially produced boilers should be accepted according to specifications of manufacturing plants with adjustment, which considers real mode of operation (increase in productivity, change in form of fuel/propellant, etc.).

5.4. Gas resistance of steam low-capacity boilers of obsolete constructions/designs can be determined according to to empirical formula

$$h_к = A\left(\frac{D}{H_к}\,\alpha_к\right)^2 - C \text{ мм вод. ст.}, \qquad (1)$$

Key: (1). mm H_2O. where D - boiler steam capacity in kg/h;

$H_к$ - surface of heating boiler in m^2;

$\alpha_к$ - excess air ratio after boiler;

A and C - coefficients, taken from Table 12.

5.5. Boiler units, as a rule, are equipped with forced-draft installations (exhaust fans and blast fans) according to principle of module design.

5.6. During planning of new boiler rooms with boilers by coefficient of evaporation to 1 t/h, and during reconstruction of boiler rooms are also allowed/assumed group (for separate groups of boilers) or general/common/total (for entire boiler room) forced-draft installations.

Table 12. Coefficients A and C for determining gas resistance of steam boilers of old constructions/designs.

(1) Котлы	A	C
(2) Жаротрубные	0,006	0
(3) Комбинированные	0,009	0
(4) Горизонтально-водотрубные	0,006	0
(5) Вертикально-водотрубные	0,001	2

Key: (1). Boilers. (2). Fluepipe. (3). Combined. (4). Horizontal-watertube. (5). Vertical watertube.

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5.7. Group or general/common/total forced-draft installations are projected/designed, as a rule, with two exhaust fans and two blast fans.

The calculated heating power of the boilers of the heating and heating-production boiler rooms, operated by these installations, is provided by the multiple operation of two exhaust fans and two blast fans.

For the production boiler rooms one exhaust fan and one blast fan are workers, the second - spare.

5.8. Productivity of forced-draft installation is determined according to data of thermal designs of boiler units.

5.9. Forced-draft machines should be selected with safety factors, given in Table 13.

5.10. Forced-draft machines, as a rule, must be equipped by axial type guiding devices, which affect characteristic Q-H of machine.

5.11. During design of forced-draft installations must be provided for measures, which ensure noise reduction to that permitted.

5.12. Parts and elements/cells of gas-air pipes, safety valves, accesses, blinkers, suspensions and supports, staircases and areas/sites, flanges, transitions, leads and sectors, valves circular and rectangular are made according to the appropriate standards confirmed in the established manner.

Table 13. Safety factors for the selection of the forced-draft machines.

(1) Котлы	Коэффициент запаса по производительности (2) для		Коэффициент запаса по давлению для	
	(4) дымососа	(5) дутьевого вентилятора	(4) дымососа	(5) дутьевого вентилятора
(6) Паропроизводительностью $D \leq 20$ т/ч	1,05	1,05	1,1	1,1
Паропроизводительностью (6) D 20 т/ч	1,1	1,05	1,2	1,1

Key: (1). Boilers. (2). Safety factor in productivity for. (3). Safety factor in pressure for. (4). exhaust fan. (5). blast fan. (6). By coefficient of evaporation.

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5.13. In sections of gas pipes, in which is possible deposit of ash, must be designed devices for their decontamination.

5.14. Arrangement/position and construction/design of rupture disks on gas pipes must correspond to requirements of "rules of device and safe operation of steam boilers" and "rules of explosion-proof character of installations for preparation and combusting fuel/propellant in dustlike state".

5.15. Efforts from thermal elongation of gas-air pipes must not

be transferred for forced-draft machines.

5.16. Gas-air pipes should be projected/designed round cross-section.

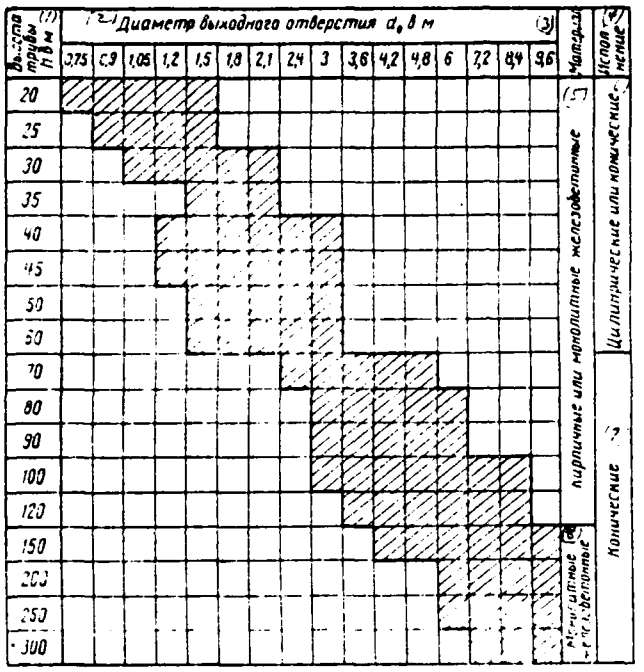

Fig. 1. Standardized series/rcw cr the typical dimensions of monolithic reinforced-cconcrete ard brick chimney stacks.

Key: (1). Height of pipe. (2). Diameter of cutlet m. (3). Material. (4). Performance. (5). Brick or monclithic reinforced concrete. (6). Cylindrical cr ccnical. (7). Ccnical. (8). Monolithic reinfcrced-concrete.

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5.17. Construction/cesign cf gas-air pipes must provide

possibility of manufacture and assembly of sections of gas-air pipes in the form of transportable blocks.

5.18. On gas-air pipes must be provided for devices for installation of monitoring and measuring tools and fastening of insulation/isolation.

5.19. For boiler room, as a rule, must be projected/designed one (general/common/total for all adjustable boilers) chimney stack. The device of several chimney stacks or individual for each boiler is allowed/assumed when justified.

5.20. Chimney stacks must be fulfilled by brick ones or reinforced-concrete ones.

The use/application of metallic chimney stacks D>1 m is allowed/assumed only when the technical and economic advisability and the resources/lifetimes of the rolled metal product of the necessary gauge are present,.

5.21. During design of separate brick or reinforced-concrete chimney stacks their sizes/dimensions should be accepted according to standardized series/row of chimney stacks (Fig. 1).

Note. On the basis of the conditions of production in the works the diameter of the mouth of duct must be not less than 0.75 m.

5.22. Standardized diameters of metallic chimney stacks - 0.4; 0.5; 0.63; 0.8 and 1 m.

5.23. During several introductions/inputs of gas pipes (flues) into chimney stack from in parallel working exhaust fans should be provided for measures, which ensure protection of flows of gas from mutual effect.

In the chimney stacks of boilers with the natural draft the dividing partitions are not provided for.

6. Decontamination of flue gases (ash collection and spark extinguishing).

6.1. Boiler rooms, intended for the work on the solid fuel (carbon/coal, peat, schists and wood withdrawals/departures), must be equipped by installations for clearing ash from flue gases when

$$N = A^p B \quad 5000, \qquad (2)$$

where A^p - ash contents in the working mass of fuel/propellant in %;

B - maximum hour calculated fuel consumption in kg.

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Notes: 1. With the work of boiler room on gaseous fuel with the use of a solid fuel as the spare should be provided for the decontamination of flue gases. In this case the gas bypass and ash catcher must be disconnected by silencers/plugs.

2. During use/application of solid fuel as emergency service of ash catchers is not required.

6.2. As ash catching devices during layer and chamber combustion of solid fuel one shcule apply dry and wet ash catchers:

Blocks of cyclones (of type NIIOGAZ, TsKTI) with quantity of flue gases to 50000 m^3/h;

multicyclone dust collectors with quantity of flue gases from 15000 m^3/h are above;

electric filters with quantity of flue gases are more than 70000

m^3/h;

wet ash catchers of type IsS-VTI (scrubber) with quantity of flue gases are more thar 100000 m^3/h.

One should accept to the installatien the ash catchers of prefabrication.

6.3. In the case when with combustien of solid fuel in dustlike state single-stage ash catchers cannot ensure sanitary requirements, should be provided fcr dry two-stage scrubbing cf gas. As the seccnd step/stage the scrubbings of gas apply electric filters.

6.4. Decontaminatien factors are accepted:

in cyclones and blccks of cyclones during layer combustion of fuel/propellant - 85-90o/o; during dustlike ccmbustion of fuel/propellant - 70-80c/o;

in multicyclone dust ccllectors during layer combustion cf fuel/propellant - 85-92o/o; during dustlike ccmbustien of fuel/propellant - 83-90c/o;

in electric filters during dustlike combtstion of

fuel/propellant and single-stage scrubbing of gas - 92-95o/o; during two-stage scrubbing of gas - 95-98o/o;

in wet ash catchers during dustlike combustion of fuel/propellant - 87-92o/o.

6.5. Ash catchers are established/installed in suction side of exhaust fans. The installation of ash catchers on the forcing side of exhaust fans is not recommended, since in this case exhaust fans undergo cinder erosion.

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6.6. Ash catchers, as a rule, must be provided for individual to each boiler unit.

During the reconstruction of boiler rooms is allowed/assumed the installation by several boilers of the group of ash catchers or one subdivided apparatus.

6.7. With work of boiler room only on solid fuel individual ash catchers must not have gas bypasses or flues.

6.8. Ash catchers can be established/installed both within

building of boiler room and outside it.

6.9. For preventing condensation of water vapors on walls of ash-catching apparatuses and flues, and also for reasons of safety engineering external surfaces of ash-catching apparatuses, supplying and gas-outlet flues are insulated.

6.10. Gas velocity in supplying flue of ash-catching installations (to avoid considerable precipitation of ash) must be 12-15 m/s.

6.11. Hoppers of ash catchers, as a rule, are fulfilled from metal; form and internal surface of hopper must provide full/total/complete descent of ash with gravity flow; in this case angle of slope of walls of hopper to horizontal takes as equal to 55-60°.

6.12. Hoppers of ash catchers must have airtight seals.

6.13. With continuous ash removal from ash bins are applied valves of type "blinker" and ash-washing apparatuses, with periodic - conical or slide gates.

Dry mechanical cleaning of flue gases.

6.14. For dry refining of flue gases are applied cyclones of type NIIOGAZ, TsKTI and battery, relied on nominal heating power of boiler. These apparatuses recover the particle of ash from 5 μ and it is above.

6.15. On the basis of technical and economic considerations and reliability of operation of cyclones and multicyclone dust collectors, ratio of hydraulic resistance ΔP in kg/m² to specific gravity/weight of gas $\gamma_г$ in kg/m³ must be in limits of 55-75, which virtually corresponds to resistance of mechanical ash catcher Δp=50-60 kg/m².

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Within the limits indicated is found the region of the optimum conditions for the work of the ash-catching installations.

In relation $\frac{\Delta P}{\gamma_г} > 75$ the decontamination factor does not grow/rise, but in this case increases the expenditure of electric power for the transportation of gas.

In relation $\frac{\Delta P}{\gamma_г} < 55$ noticeably descends the decontamination

factor.

6.16. Cyclones and multicyclone dust collectors must be established/installed vertically.

6.17. Are recommended to use/application blocks of cyclones NIIOGAZ of type TsN-15 and TsKTI type Ts-16 with a diameter of 400-800 mm. These blocks are composed into the groups, having not more than eight cyclones.

Tentative interception coefficient of the ash of fraction ≥ 10 μ for the cyclones with a diameter of 400 mm - 89o/o and by the diameter of 800 mm - 85o/o.

The values of the coefficients of hydraulic resistance of mechanical ash catchers are given in Table 14.

Table 14. Values of the coefficients of hydraulic resistance of mechanical ash catchers.

Золоуловитель	Тип направляющего аппарата	Диаметр элемента (условный) в мм	Коэффициент гидравлического сопротивления ζ
Блок циклонов:			
НИИОГАЗ типа ЦН-15	—	—	125
ЦКТИ типа Ц-16	—	—	110
Батарейный	Розетка, $\alpha = 25°$	250	90
	Розетка профилирования ЦКТИ, $\alpha = 25°$	250	65

Note. The coefficient of hydraulic resistance of unit cyclones should be accepted upon 10%/c less than indicated in the table.

Key: (1). Ash catcher. (2). Type of guiding device. (3). Diameter of element/cell (conditional) in mm. (4). Coefficient of hydraulic resistance. (5). Block of cyclones. (6). type. (7). Battery. (8). Baffle/socket. (9). Baffle/socket of profiling.

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Wet ash catchers.

6.18. Wet ash catchers of type TsS-VTI are applied during combustion of solid fuel with given sulfur content not more than 1%/o, and by temperature of flue gases not higher than 200°C. In this

case acid water (after ash catchers) must be neutralized.

The use/application of reverse water supply is not allowed/assumed.

6.19. To provide for installation of wet ash catchers of type IsS-VTI during combustion of fuel/propellant in ash of which is contained considerable quantity of lime (more than 20o/o CaO according to mineral analysis), it is not recommended; also one should not for irrigation of scrubbers apply water, not purified from mechanical impurities, with total concentration of sulfite and bicarbonate, which exceeds 15 mg-equiv/l.

6.20. Wet ash catchers during their installation out of building in regions with calculated winter temperature of air are below - 15°C one should establish/install with warming of zone of maintenance/servicing injectors and lower part of scrubber (dust removal).

During the installation of ash catchers in the open air for preventing the condensation of water vapors on the walls of the supplying flues inlet elbows of ash catchers, composite duct and gas-outlet flues to the exhaust fans must be insulated.

6.21. Rated speed of flue gases in cross section of scrubber must be not more than 5 m/s.

During the load variation (under operating conditions) is allowed/assumed an increase in the gas velocity against the calculated by 10% or the decrease of AN 20%.

To one boiler one should establish/install not more than 4 apparatuses.

6.22. Pressure of water in upper sprinkling nozzles must be from 0.1 to 0.15 Atm(gage), but in front of washing nozzles of periodic action - not less than 2.5 Atm(gage).

Ash collection and spark extinguishing during the combustion of wood withdrawals/departures.

6.23. Boiler rooms, which burn wood withdrawals/departures, in all cases, independent of quantity of burned fuel/propellant, they are equipped by devices for spark extinguishing and devices for catching of fly ash in accordance with indications p. 6.1.

6.24. Devices for catching of ash and quenching of sparks should be established/installed after tail heating surfaces.

6.25. As devices for catching of ash and quenching of sparks one should accept wet and dry ash catchers and spark arresters.

6.26. Spark arresters are established/installed, as a rule, on chimney stacks of boiler rooms, which work on natural draft. With mechanical draft the spark arresters are established/installed in the presence of dry mechanical ash catchers.

During the installation of wet ash catchers the spark arresters are not established/installed.

7. Deaerating-feed and heat exchange installations, tank-storage batteries/accumulators, installations of the collection of condensate.

7.1. In deaerating-feed installation are included deaerators, pumps of feed water and extinguishing compounds of explosion.

7.2. In boiler installations for deaeration of feed water of steam boilers and water of thermal networks/grids should be applied thermal deaerators. In accordance with GOST [All-union State

Standard] 9654-61 "deaerators thermal of feed water and tanks of the deaerated water for stationary boiler installations" and GOST 10942-64 "deaerators vacuum thermal for the thermal networks/grids. The basic parameters and the technical requirements" thermal deaerators are subdivided into the following types:

the mixing vacuum to the pressure 0.3 kgf/cm²;

the mixing atmospheric to the pressure 1.2 kgf/cm²;

mixing the mean pressure to a pressure of 3.5 kg/cm²;

mixing of elevated pressure on the pressure 6 and 7 kg/cm²;

vacuum to the pressure, equal to pressure at a temperature of the saturation of the deaerated water.

The typical dimensions of the mixing deaerators, intended for the boiler rooms, and the useful tank capacity of the deaerated water to them are accepted on the in force state standards.

7.3. In boiler rooms with steam boilers one should apply atmospheric type mixing thermal deaerators.

Vacuum deaerators are recommended to the installation in the following cases:

for the deaeration of makeup water in the boiler rooms with hot-waters boiler;

for the deaeration of feed water in the boiler rooms with steam boilers with the impossibility of guaranteeing the normal work of feed pumps with the temperature of water it is higher than 70°C, and also in cases when an increase in the temperature of feed water to 102-104°C causes an increase in the temperature of stack gases.

7.4. Deaeration of feed water and water for additional feeding of thermal networks/grids should be manufactured in separate deaerators. In the closed system of heat supply is allowed/assumed the installation of general/common/total deaerators.

7.5. During determination of productivity of deaerators expenditure/consumption of water for additional feeding of thermal networks/grids is accepted in accordance with instructions of chapter SNIP [Construction norms and regulations] II-G.10-62.

7.6. During design of deaerating-feed installations should be provided for continuous feed into deaerator of all flows of water,

including condensate from production and from drainage devices.

The weighted mean temperature of all flows must be not less than on 10°C lower than temperature of saturation of steam at a pressure in the deaerator.

The flows of water with the temperature lower than temperature of saturation of steam must be directed to the upper plate of the column of deaerator, and with the temperature higher than temperature of saturation - it is direct in the tank of deaerator or in the bubbling section.

7.7. For creation of vacuum in vacuum-deaerating installations should be applied water-jet or steam-jet ejectors.

For the water-jet ejectors should be provided for the installation of special pumps.

7.8. With vacuum-deaerating installations one should provide for maximally possible preheating of water.

7.9. In boiler rocss, as a rule, is established/installed one deaerating-feed installatica.

7.10. Capacity/capacitance cf supply tank (tanks) must be not less than 20-30 minute peak cutputs of bcilers.

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7.11. Height of installatica of thermal deaerators of atmospheric type or tanks of feed water above axis/axle of feed pump with electric drive must exclude possibility cf vaporization.

7.12. If necessary cf reducing mark of installation of deaerators one should establisn/irstall quenching ccmpounds cf deaerated water in suctica line cf pumps.

Note. The thermal circuit cf tciler rocm must provide fcr the use of water, heated in the quenching compounds of the deaerated water.

7.13. Determinatica of capacity of pumps cf feed water and their quantity is manufactured:

for boilers with pressure of steam is more than 0.7 Atm(gage) - in accordance with "rules of device and safe operation of steam boilers" of Gosgortekhnadzor [State Committee of the Council of Ministers for Supervision of Industrial Safety and for Mining Inspection] USSR;

for boilers with pressure of steam is not more than 0.7 Atm(gage) - in accordance with "Rules of device and safe operation of hot-waters boiler and steam boilers with pressure not more than 0.7 Atm(gage)".

7.14. Design pressure of feed pumps of steam boilers should be determined from formula

$$H = 1{,}15 \cdot 10 (P_б - P_д) + H_в + H_г \text{ м вод. ст.}, \quad (3)$$

(1)

Key: (1). m water column.

where $P_б$ - great possible overpressure in the boiler barrel in kgf/cm²;

$P_д$ - overpressure in the deaerator in kgf/cm²;

H_c - the total resistance of the suction and forcing channel of feed water in m H_2O;

H_r - geometric difference in the water level in the boiler barrel and the deaerator m.

7.15. Feed pumps, connected to general/common/total main line, must have characteristics, which allow/assume their multiple operation.

7.16. Installations for preheating network water in boiler rooms with steam boilers are projected/designed, as a rule, with general/common/total ones for all boilers.

In the heating boiler rooms with steam boilers is allowed/assumed, according to the agreement with the plant - the producer of boilers, preheating network water in the heat exchangers, built in into the boiler barrels, and also built on above them, connected with the circulation loop of the boiler.

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In these boiler rooms water economizer is utilized for preheating of network water or water for the hot water supply.

7.17. Quantity of adjustable heat exchangers for preheating network water is calculated, but must be them not less than two. The surfaces of heating heat exchangers are accepted with the supply into 10c/o. Spare heat exchargers are not established/installed.

7.18. Heating power of heat exchangers for preheating water, including quenching compounds of condensate, takes as equal to sum of maximum hourly consumptions of heat per heating and ventilation and calculated heat consumption per it is hotter water supply.

Depending on the system of heat supply calculated heat consumption per hotter water supply is accepted according to the data of Chapter SNIP II-G.10-62.

7.19. In boiler rooms with water-heating ones or with steam boilers and heat exchargers for preheating network water must be established/installed not less than two pumps for circulation of water in system of heat supply. One of the pumps is worker, another - spare. The required productivity of pumping station is determined on the basis of the graph of control and graph of the calculated expenditures/consumptions of water accepted in the thermal network/grid.

A quantity of circulating pumps and their unit productivity should be determined on the basis of their most economical work during the year.

The necessary pressure of network pumps is defined as the sum of losses of pressure in the boiler room, in feeding and return lines of external thermal network/grid and losses of pressure in the local systems of heat consumption (including losses of pressure in the thermal point/item or the node).

During installation of two or more working pumps their characteristics must allow/assure the multiple operation of these pumps.

7.20. Is recommended installation of special pumps for work in summer period; it is allowed/assumed use for work during this period of makeup pumps.

7.21. Additional feeding of thermal networks/grids must be accomplished/realized continuously with the aid of makeup pumps or directly from feed capacities/capacitances.

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A number of makeup pumps must be not less than two, one of them spare.

7.22. Selection of makeup pumps, determination of capacity/capacitance of tank-storage batteries/accumulators of hot water, and also design of installations of collection of condensate are manufactured in accordance with demands of Chapter SNIP II-G.10-62.

8. Conduits/manifolds.

8.1. Conduits/manifolds of boiler rooms, quality of materials used and their characteristic must satisfy the requirements of acting rules of Gosgortekhnadzor of USSR.

The conduits/manifolds of the boiler rooms in question are placed in the 3rd and 4th categories.

8.2. General/common/total composite pipelines of steam and hot water, and also steam supplies to reduction, water-heating and other installations, as a rule, must be projected/designed with single ones.

8.3. Between steam boiler and composite steam supply of boiler room, hot-water boiler and supplying and discharge water lines should be provided for close fitting valve (valve/gate or catch). When, in steam boiler, steam superheater is present, the close fitting valve must be established/installed after it.

Note. Upon the connection of several boilers to the composite pipelines, for the purpose of the facilitation of operating conditions, on the connecting to the boiler steam supply (water line) is allowed/assumed the installation of the second close fitting valve, arranged/located on the composite pipeline. In hot-waters boiler instead of the second close fitting valve it is allowed/assumed to establish/install two-way valve.

8.4. If necessary for reduction of steam in boiler room should be provided for one reduction installation (ROU) to each vapor pressure of reduced. Reduction installation (ROU) it is allowed/assumed to reserve by the bypass on which should be established/installed two catches (one locking and one gauging), two manometers (by one afterward locking, by another after the gauging catch) and calculated quantity of safety valves.

8.5. Branch pipes from safety valves must be brought out beyond limits of boiler room and have deflector of water (branch with valve/gate).

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The cross-sectional area of branch/drain duct they must be not less dual cross-sectional area of safety valve.

8.6. Disconnected sections, and also lower and end points of steam supplies must have devices for periodic blasting and diversion/tap of condensate (branch with valve/gate).

8.7. On drain, blowoff and drainage lines, independent of pressure of steam in steam supply, should be provided for installation of one shutoff valve (catch).

8.8. Blind sections of pipelines steam with pressure P≥0.7 Atm(gage) must have devices, which ensure continuous diversion/tap of condensate.

8.9. In boiler rooms, equipped by boilers by pressure it is more than 0.7 Atm(gage) and by coefficient of evaporation 4 t/hs and more with layer combustion of fuel/propellant, and also boilers whose

drums are warmed by gases, with any ignition method of fuel/propellant pipelines for feed of boilers are fulfilled by dual ones. In the remaining cases feed pipelines are fulfilled by single ones.

In the boiler rooms, equipped by boilers with the pressure of steam is not more than 0.7 Atm(gage), feed pipelines should be fulfilled single ones.

Note. In the boiler rooms with the boilers, equipped built on or built in the boiler barrel by heat exchangers, with the pressure of steam of more than 0.7 Atm(gage) is allowed/assumed device according to the agreement with the organs/controls of Gosgortekhnadzor of the USSR single feed pipelines.

8.10. During group installation of feed pumps feed pipelines for boilers by pressure of steam is more than 0.7 Atm(gage), as a rule, they are fulfilled by dual ones.

With the installation of boiler assemblies with individual feed pumps feed pipelines must be provided for by single ones.

8.11. Installation of group ones and so-called "disconnected" feed-water economizers must provide possibility of

cutoff/disconnection of them both on gas and on water.

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The individual "disconnected" economizers it is allowed/assumed to establish/install without the gas bypass, providing for in this case screw lines or other devices, which make it possible to pump through the water through the economizer besides the boiler.

On the bypass feeder lines is provided for the close fitting valve for the possibility of the feed of boiler, passing economizer.

8.12. On screw pipeline of boiler unit upon connection to general/common/total screw pipeline of boiler room should be established/installed besides close fitting valve and check valve.

8.13. During installation "not disconnected" on water of individual feed-water economizer close fitting valve (valve/gate or catch), reverse valve and feed regulator they must be established/installed on feed pipeline at entrance into economizer. During the installation of cast iron, "not disconnected" on the water of economizer, on the pipeline between the boiler and the economizer should be additionally established/installed check valve.

8.14. For preventing increase in pressure and temperature of water in hot-water boiler, with emergency shutdown of circulating pumps on pipeline or collector/receptacle of diversion/tap of hot water from boiler must be provided for, to close fitting valve, drain device in diameter not less than 50 mm with close fitting valve (valve/gate or catch) for derivation.

8.15. Pipelines for descent of water and blasting of boiler must be connected up appropriate branches, provided for by construction/design of boiler. To provide for in the project additional drain ones and blowoff ones branch is not permitted.

8.16. On each drain and blowoff pipeline of boiler must be established/installed close fitting valve (valve/gate or catch). The diameter of the internal diameter of drain and blowoff pipeline, and also close fitting valve should be assumed equal to the diameter of the corresponding branch of boiler.

8.17. For periodic blasting of boilers by pressure higher than 8 Atm(gage) on pipelines of blasting must be established/installed consecutively/serially or two valves/gates.

For the blasting of steam superheater chambers is allowed/assumed the installation of one valve/gate.

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8.18. On pipeline of continuous blasting besides special regulating unit (consecutively/serially after it) must be established/installed close fitting valve (valve/gate or catch).

8.19. For periodic descent of water or periodic blasting of boiler should be provided for general/common/total composite drain and blowoff pipelines.

8.20. On general/common/total composite blowoff or drain pipelines installation of close fitting valve is forbidden. Is allowed/assumed the installation of close fitting valve on the composite drain or blowoff pipeline, which unites several drain or blowoff points only of one boiler.

8.21. For continuous blasting should be provided for separate blowoff pipelines for each boiler.

8.22. In sections of pipelines where is possible air lock, must be established/installed devices for its removal/distance.

8.23. Distance from isolated/insulated surface of pipelines to columns, equipment and the like must provide convenience in assembly, repair and maintenance/servicing (taking into account extent of thermal movement) and be not less than 25 mm.

Pipelines must be laid with the draft/gradient not less than 0.001; free pass under the pipelines must be not less than 2 m.

8.24. For convenience in servicing pipelines and fittings is allowed/assumed device of staircases and areas/sites.

8.25. Determination or diameters of pipelines of steam and water should be manufactured on the basis of maximum calculated coolant flow rates and allowable speed of transported medium (Table 15).

The speed of water in the pipelines is recommended to accept to 2.5 m/s.

8.26. During design of pipelires should be provided for compensation for thermal elongations due to autocompensation or installation of compensators.

Table 15. Recommended speeds of steam in the pipelines.

(1) Условный проход D_y в мм	(2) Скорость пара в м/сек	
	(3) перегретого	(4) насыщенного
200	50	40
200	70	60

Key: (1). Internal diameter D_y in mm. (2). Speed of steam in m/s. (3). overheated. (4). saturated.

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Flexible compensators, as a rule, must be established/installed in the horizontal plane; sometimes it is allowed/assumed to establish/install them in the vertical or inclined plane.

During the calculation of flexible compensators should be considered their preliminary trace, equal to the half the value of compensation capacity.

8.27. For pipelines should be provided for fixed and movable supports.

When the vertical thermal displacements/movements of pipelines are present, should be applied spring cushions and suspensions.

8.28. Loads from pipelines for calculating constructions/designs of movable and fixed supports are accepted according to recommendations of Chapter SNIP II G.10-62.

8.29. Pipelines must be welded. On the flanges are collected the pipelines whose execution by welding is impossible for assembly reasons.

The use/application of sleeve joints is allowed/assumed on the pipelines whose diameter is not more than 50 mm.

8.30. During development or erection drawings of pipelines of boiler rooms one should proceed from condition for block prefabrication of pipelines and their block delivery.

9. Water treatment.

General/common/total indications.

9.1. During design of boiler installations in part of water treatment must be solved questions:

water treatment for boilers, thermal networks/grids and sometimes for production users;

organization of chemical laboratory and equipment of places for sampling, which ensure reliable water/aqueous-chemical check by boiler room;

organization of reagent economy.

9.2. Methods of water treatment and diagram of water-treatment installation are selected depending on demands of users for chemically purified water, quality of initial water, sanitary requirements, technical and economic considerations and magnitudes of losses of steam and condensate.

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9.3. Pre-boiler water treatment, as a rule, must be provided for for following boilers:

steam shielded water-tube independent of their coefficient of evaporation and form of burned fuel/propellant;

steam unshielded water-tube during combustion of gas and

petroleum residue;

all water-heating;

steam cast iron sectional.

Note. With the feed of steam cast iron sectional boilers by water, in which predominates the carbonate hardness, is allowed/assumed magnetic water treatment.

9.4. Internal boiler water treatment is allowed/assumed for following boilers, which work without steam superheaters:

steam unshielded water-tube by coefficient of evaporation is less than 0.7 t/hs with pressure of steam up to 14 Atm(gage), which work on solid fuel;

gas-turbine and fluepipe;

vertical water-tube.

With the rigidity of feed water of more than 3 mg·equiv/l the use/application of internal boiler treatment is not recommended.

9.5. Selection of method of water treatment and engineering calculations of equipment of water treatment must be fulfilled on basis analysis of initial water whose results must contain given in accordance with p. 12 of GOST 2761-57 "Sources of centralized household-drinking water supply. Rules of selection and estimation of quality".

For the water of the open sources is fulfilled the series/row of the analyses, which characterize the worse indices, for example, maximum salinity, rigidity, etc. in the preflood period (March, April) or in the period of the desiccation of the source of water supply; the maximum content of suspended matter and the oxidizability, characteristic in the period of seasonal flood or cloudbursts.

The diversity of surface water requires conducting test coagulation and their deironing for the purpose of the establishment of the optimum ones: temperature, dosage of reagents, most favorable medium (pH) for the coagulation and the deironing, etc.

For the artesian water it is sufficient two analyses, undertaken in different time also of confirming constancy qualitative indices.

9.6. For solving question about need for condensate treatment, returned from production, must be its known quality: alkalinity, rigidity, salinity, concentration of ammonia, iron, copper, oils, oil-products and so forth, etc.

Norms of quality of steam, boiler, feed and makeup water.

9.7. Salinity of saturated steam for boilers with steam superheaters should be accepted:

a) for nominal pressure 8-13 Atm(gage) - 1000 μg/kg;

b) for nominal pressure 23 Atm(gage) - 300 μg/kg, if to quality of steam are not preserted special requirements.

Note. Salinity is determined by the electrometric method with the preliminary degassing, the method of flame photometry or concentration of the ions (it is sufficient cations) on the ionite filters.

9.8. Content of carbonic acid in steam must not exceed 20 mg/kg.

9.9. Humidity of steam for boilers without steam superheaters must not exceed 1o/o, if to quality of steam are not presented special requirements.

9.10. Quality of boiler (blowoff) water when selecting of diagrams of water treatment for steam boilers is normalized on general/common/total salinity (dry residue), which is accepted in dependence on construction/design of boiler (separating devices) and is established/installed by manufacturing plant.

9.11. Calculated dry residue of boiler (blowoff) water for boilers of types DKVR, DKV and KBSr is accepted on tables 16 in dependence on type of separative devices which equipped boiler.

9.12. Absolute general/common/total alkalinity of boiler water in clean section, and also in boiler without stepped evaporation with feed of boilers by softened water is accepted not less than 1 mg•equiv/l.

The maximum value of the absolute alkalinity of boiler (blowoff) water is not normalized.

9.13. Relative alkalinity of boiler water for boilers, which have riveted joints and workers on pressure is more than 8 Atm(gage),

it must not exceed 20c/c.

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Notes: 1. Separative devices, by which is equipped the boiler, are selected taking into account the quality of feed water and permissible value of the blasting of boilers.

2. Boilers with steam superheaters, as a rule, are equipped by stepped evaporation and outside cyclones.

3. In boilers with stepped evaporation dry residue of boiler water in clean section $S_{к.в}$ must be not above 1500 mg/l; its value is determined from to formula

$$S_{к.в} = \frac{S'_{к.в}}{K_с} \text{ мг/л}, \qquad (4)$$

Key: (1). mg/l.

where $S'_{к.в}$ and $S''_{к.в}$ - salinity of boiler water in the clean and saline sections of boiler in mg/l;

$K_с$ - salt multiplicity, determined according to the formula

$$K_с = \frac{h + P''_п}{P''_п}, \qquad (5)$$

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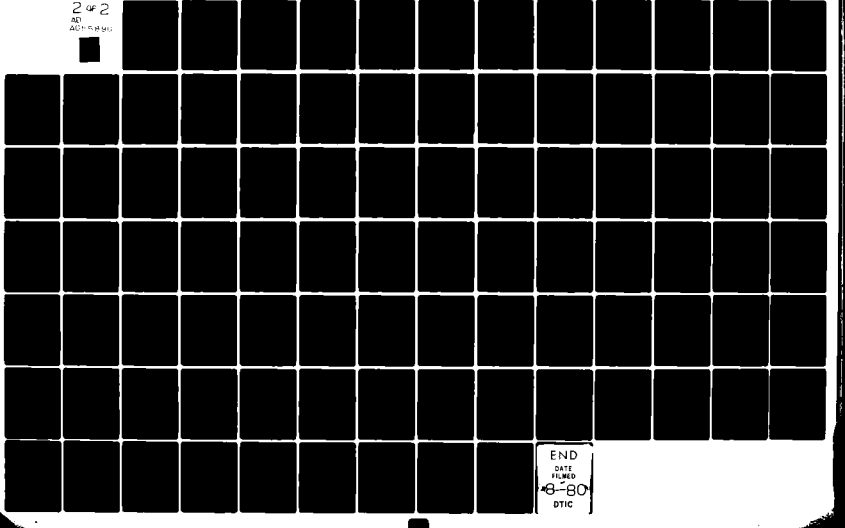

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A - coefficient of evaporation of salt section in o/o from the general/common/total boiler steam capacity; is accepted according to the specifications of boiler;

P_n^p - the calculated value of the blasting of boiler in o/o.

4. Norms of quality of boiler water, indicated in Table 16, consider load of boilers to 150o/o of nominal.

5. Quality of boiler (blowoff) water is normalized only on general/common/total salinity (dry residue) without account to absolute alkalinity of boiler water.

9.14. For welded boilers to pressure of more than 10 Atm(gage) with relative alkalinity of boiler water from 20 to 50o/o should be provided for water treatment by nitrates or analogous passivators.

Table 16. Calculated dry residue of boiler (blowoff) water for the boilers of types DKVE, DKV and KSH.

(1) Тип сепарационного устройства	(2) Сухой остаток в мг/л, не более
(3) Механические внутрибарабанные сепарационные устройства	3 000
(4) То же, с применением внутрибарабанных циклонов	4 000
(5) Двухступенчатое испарение и механические внутрибарабанные сепарационные устройства	6 000
(6) Выносные циклоны при двухступенчатом испарении	10 000

Key: (1). Type of separative device. (2). Dry residue into mg/l, not more. (3). Mechanical intra-drum separative devices. (4). Then, with use/application of intra-drum cyclones. (5). Two-stage evaporation and mechanical intra-drum separative devices. (6). Outside cyclones with the two-stage evaporation.

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Dosing of nitrates into the chemically purified water is determined from the formula

$$N = 16\,Щ_x \quad g/м^3 \qquad (6)$$

where N - dosage of nitrates in that chemically purified - water in $g/м^3$;

$Щ_1$ - alkalinity of the chemically purified water in mg•equiv/l.

The relative alkalinity of boiler water of more than 50o/o is not allowed/assumed.

9.15. Calculated norms of quality of boiler water during internal boiler working for boilers by pressure of more than 0.7 Atm(gage) are given in Table 17.

Note. For the purpose of the more full/totaler/more complete precipitation of scale-formings constituent in the form of sludge the minimum alkalinity of boiler water at the internal boiler treatment one should support for all boilers not below 7-10 mg•equiv/l.

9.16. General/common/total alkalinity and dry residue of feed water are not normalized, but depend on those selected in accordance with norms and methods water treatments.

Table 17. Calculated norms the quality of boiler water during the internal boiler treatment.

(1) Котлы	(2) Показа ели качества	(3) Единица измерения	(4) Расчетная норма
(5) Водотрубные без нижних барабанов и грязевиков	(6) Сухой остаток	(7) мг/л	2500
	(8) Щелочность	(9) мг·экв/л	11
	(10) Шламосодержание	(2) мг/л	2000
(11) Водотрубные с нижними барабанами	(1) Сухой остаток	(2) мг/л	4000
	(2) Щелочность	(3) мг·экв/л	16
	(3) Шламосодержание	(2) мг/л	12 000
(12) Водотрубные с грязевиками	(1) Сухой остаток	(2) мг/л	4 500
	(2) Щелочность	(3) мг·экв/л	18
	(3) Шламосодержание	(2) мг/л	20 000
(13) Газотрубные	(1) Сухой остаток	(2) мг/л	4000
	(2) Щелочность	(3) мг·экв/л	14
	(3) Шламосодержание	(2) мг/л	5000
(14) Жаротрубные	(1) Сухой остаток	(2) мг/л	16 000
	(2) Щелочность	(3) мг·экв/л	25
	(3) Шламосодержание	(2) мг/л	7 000

Key: (1). Boilers. (2). Qualitative indices. (3). Unit measurement. (4). Calculated norm. (5). Water-tube without lower drums and sludge pans. (6). Dry residue. (7). mg/l. (8). Alkylinity. (9). mg·equiv/l. (10). Sludge content. (11). Water-tube with lower drums. (12). Water-tube with sludge pans. (13). Gas-pipe. (14). Fluepipe.

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The alkalinity of feed water is determined from the formula

$$Щ_{п.в} = a_1 Щ_к + (1 - a_1) Щ_к \text{ mg·equiv/l} \qquad (7)$$

where $Ш_{п.в}$ - alkalinity of feed water in mg•equiv/l;

$Ш_к$ - alkalinity of condensate in mg•equiv/l; in the absence of data on the quality of condensate the alkalinity takes as the equal to 0.05 mg•equiv/l;

$\alpha_х$ - share of the chemically purified water in the feed.

The dry residue of feed water $S_{п.в}$ is determined from the formula

$$S_{п.в} = \alpha_х S_х + (1 - \alpha_х) S_к \text{ mg/l} \qquad (8)$$

where $S_к$ - the dry residue of condensate in mg/l; in the absence of data about the quality of condensate the dry residue takes as equal to 5 mg/l;

$S_х$ - the dry residue of the chemically purified water in mg/l.

9.17. Norms of quality of feed water for steam boilers during preboiler water treatment are accepted on Table 18.

Table 18. Norms of the quality of feed water for steam boilers during preboiler water treatment.

(1) Котлы	(2) Жесткость воды общая в *мг-экв/л*	(3) Растворенный кислород для котлов в *мг/л*		(4) Содержание железа в *мг/л*	(5) Содержание масла в *мг/л*
		(6) без экономайзеров или с чугунными экономайзерами	(7) со стальными экономайзерами		
(8) Газотрубные, жаротрубные и вертикально-цилиндрические . .	0,03—0,5 (9)	Не нормируется	—	—	—
(10) Чугунные секционные	0,3	То же	—	—	—
(11) Водотрубные неэкранированные при сжигании твердого топлива	0,03	0,1	0,03	0,2	5
(12) Водотрубные экранированные при сжигании твердого топлива и неэкранированные при сжигании газа и мазута	0,02	0,1	0,03	0,2	3

Note. Free carbonic acid in the feed water must be absent.

Key: (1). Boilers. (2). Water hardness general/ccmmcn/total in mg•equiv/l. (3). Dissolved oxygen for boilers in mg/l. (4). Content of iron in mg/l. (5). Content of oil in mg/l. (6). without economizers or with cast iron eccnomizers. (7). with steel economizers. (8). Gas-pipe, flue-pipe and vertical-cylindrical. (9). It is not normalized. (10). Cast iron sectional. (11). Water-tube not shielded during combustion of solid fuel. (12). Water-tube shielded during combustion of solid fuel and not shielded during combustion of gas and petroleum residue.

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1. Rigidity of feed water for the boilers, which work on the solid fuel, -0.5 mg·equiv/l, for the boilers, gas-fired and petroleum residue, -0.03 mg·equiv/l.

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9.18. Norms of quality of makeup water for thermal networks/grids of closed and open systems of heat supply, and also systems of centralized hot water supply, with preheating of network water in boilers or hot-waters boiler are accepted on tables 3 of chapter SNiP II G.10-62.

9.19. For water-heating cast iron sectional boilers norms of makeup water for closed systems of heat supply are accepted on tables 19.

9.20. In water-treatment installations of boiler rooms, as a rule, is utilized water of household drinking water pipe.

If necessary to utilize in boiler water directly from its open sources should be treated in accordance with the recommendations p. 9.21.

9.21. For removal/distance from water of open sources of weighed

and organic matter are recommended following methods of water treatment:

a) filtration also coagulation of water on clarifying filters (fraction of anthracite 0.5-1.2 mm) for water with content of suspended matter to 50 mg/l;

b) the same, with two-layered loading: from quartz sand (fraction 0.5-1.2 mm) and anthracite (fraction 0.8-1.8 mm) for water with a content of suspended matter to 100 mg/l;

c) water treatment and clarifiers with content in water of suspended matter is more than 100 mg/l;

d) liming with coagulation in the clarifiers when initial water requires reduction in the alkalinity, coagulation and bright dipping.

Table 19. Norms of the quality of makeup water for the water-heating cast iron sectional boilers.

(1) Наименование показателей	(2) Единица измерения	(3) Нормы качества
Содержание кислорода	мг/л	Не нормируется
Жесткость общая	мг·экв/л	То же
Жесткость карбонатная	»	0,7—1,5

Note. The carbonate hardness of more than 0.7 mg•equiv/l is allowed/assumed with the oxidizability of water of more than 6 mg/l O_2.

Key: (1). Designation of indices. (2). Unit measurement. (3). Norms of quality. (4). Oxygen content. (5). Rigidity general/common/total. (6). Rigidity carbonate. (7) mg/l. (8) mg•equiv/l. (9). It is not normalized. (10). The same.

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Notes: 1. The value of the concentration of suspended matter is accepted for the period with the maximum turbidity (flood).

2. Coagulation of initial water is manufactured by oxidizability of more than 15 mg/l O_2 and concentration of iron of more than 1 mg/l in unfiltered test/sample.

9.22. For softening and reducing alkalinity initial of water are recommended following methods:

sodium- cationization when is not required reductions in alkalinity of initial water, but quality of steam satisfies the requirements in content of carbonic acid and increase in salinity of chemically purified water due to cation exchange (calcium and magnesium to sodium) is admissible; for obtaining deeply softened water is applied two-stage sodium- cationization;

sodium-ammonium-cationization when simultaneously with softening is required reduction of alkalinity of boiler water and protection of steam-condensation channel from carbonic acid corrosion. This method should not be applied, if: a) there is the danger in the ammonium corrosion of the equipment, manufactured from brass and other copper alloys;

b) the applied for the technological targets steam does not allow/assume the content of ammonia;

c) water or steam is utilized for the "open" systems of the heat supply;

hydrogen-cationization with the subsequent removal/distance of

carbonic acid (decarbonization), when is necessary a reduction in the relative alkalinity and content of carbonic acid in steam. This method one should be used in the direct-flow/ramjet diagrams of water treatment for the artesian or tap water, which passed cleaning constructions. Possibly also the use/application of a method of a hydrogen-cationization with the "hungry" regeneration of the filters;

Sodium-chlorine-ionization when it is necessary with the softening to simultaneously decrease the alkalinity of initial water and the content of carbonic acid in steam;

liming with the coagulation - when treatment undergoes water from the open source and is required a reduction in the alkalinity, salinity, oxidizability, and also bright dipping and deironing;

caustic-soda, lime-soda and thermochemical - permitted sometimes.

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Selection of the diagram of water treatment for steam boilers.

9.23. Basic criteria for selection of diagram of water treatment for steam boilers are value of blasting of boilers (paragraphs

9.24-926), relative alkalinity of boiler water (paragraphs 9.13; 9.14 and 9.28) and content of carbonic acid in steam (paragraphs 9.29 and 9.30).

9.24. Calculated value of blasting of steam boilers on dry residue must not be more than 10%/c from coefficient of evaporation of boiler room.

The losses of steam and condensate in the calculation of blasting enter in the maximum magnitude of losses, expressed in the percentages of the coefficient of evaporation of boiler room.

For reducing the value of the blasting of boilers it is recommended:

a) an improvement in the separation - intra-drum cyclones, stepped evaporation, stepped evaporation with the outside cyclones;

b) the selection of the diagram of water treatment, which ensures a reduction in the salinity.

9.25. Value of blasting of boilers is determined from formula

$$P_{\text{п}} = \frac{S_{\text{х}} \Pi_{\text{к}} \cdot 100}{S_{\text{к.в}} - S_{\text{х}} \cdot \Pi_{\text{к}}} \text{ мг/л}, \qquad (9)$$

where $P_{\text{п}}$ -- value of blasting of boilers into c/c; $\Pi_{\text{к}}$ — total losses

of steam and condensate in fractions/portions of coefficient of evaporation of boiler room; S_x— dry residue of chemically purified water in mg/l; $S_{k.v}$— dry residue of boiler water in mg/l, taken according to norms, established/installed for accepted in project type of boiler.

9.26. With value of blasting it is more than 2%/c from coefficient of evaporation of boiler room and when blasting is more than 0.5 t/h , besides periodic, must be provided for continuous blasting.

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With the value of blasting or less than 0.5 t/h the economic advisability of continuous blasting is established/installed by calculation.

With the value of the continuous blasting of boilers of more than 1 t/h is recommended the use of heat of blowoff water by a method of installation of the separator of continuous blasting and heat exchanger.

With the value of the continuous blasting of boilers from 0.5 to 1 t/h is established/installed only the separator of continuous

blasting.

9.27. After solution of question about advisability of continuous blasting value of latter is calculated from formula

$$P_{н.п} = \frac{S_х Щ_к \cdot 100}{S_{к.в} - (1-\beta) S_х Щ_к} \%, \qquad (10)$$

where $S_{к.в}$ - dry residue of boiler water; it is accepted according to specifications of boiler or on tables 16; β - fraction/portion of steam separated in separator or continuous blasting, determined according to formula

$$\beta = \frac{i_{к.в} - i_{с.в}}{i_п - i_{с.в}}, \qquad (11)$$

$i_{к.в}, i_{с.в}, i_п$ — enthalpy of boiler, separated water and steam in kcal/kg.

9.28. Relative alkalinity of boiler water must answer conditions, presented in paragraphs 9.13 and 9.14.

The value of the relative alkalinity of boiler water is equal to the relative alkalinity of the chemically purified water and is determined from the formula

$$Щ_{о.ф}^{к.в} = Щ_{о.т}^{х} = \frac{40 Щ_х \cdot 100}{S_х} \%, \qquad (12)$$

where $Щ_{о.ф}^{к.в}$ - alkalinity relative of boiler water into o/c; $Щ_{о.т}^{х}$ - alkalinity relative of the chemically purified water into o/c; $Щ_х$ — alkalinity of the chemically purified water in mg•equiv/l; $S_х$ — the dry residue of the chemically purified water in mg/l.

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The alkalinity of the chemically machined water should be accepted for the diagrams:

a) sodium- cationization, the equal to alkalinity initial water

$$Щ_х = Щ_{н.в} \text{ mg•equiv/l;}$$

b) coagulation - sodium- cationization

$$Щ_х = Щ_{н.в} - K \text{ mg•equiv/l;}$$

c) with the preliminary liming

$$Щ_х = 1 \text{ mg•equiv/l;}$$

d) hydrogen-sodium-cationization and ammonium-sodium-cationization

$$Щ_х = 0,5 - 0,7 \text{ mg•equiv/l,}$$

where $Щ_х$ — alkalinity of the chemically machined water in mg•equiv/l; $Щ_{н.в}$ — alkalinity of initial water in mg•equiv/l; K - dose of

coagulant, introduced into the machined water, in mg•equiv/l.

9.29. Carbonic acid concentration in steam in mg/kg in the absence of deaeration of feed water and treatment of additional water on diagram of sodium-cationization is determined from formula

$$C_{yr} = 22 Щ_x a_x (1 + \sigma) \text{ mg/kg}, \qquad (13)$$

where C_{yr} - carbonic acid concentration in steam in mg/kg; $Щ_x$ - alkalinity (bicarbonate) of chemically purified water in mg•equiv/l; σ -fraction of expansion Na_2CO_3 in boiler at appropriate pressure is accepted on Fig. 2; a_x — share of chemically purified water in feed water.

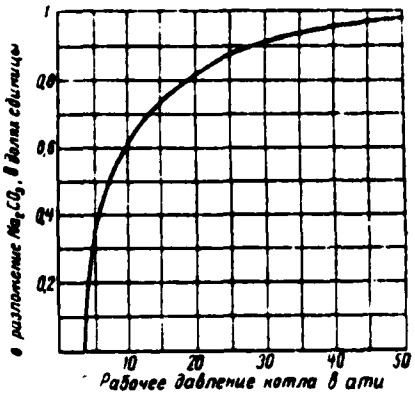

Fig. 2. Graph of expansion Na_2CC_3 in depending on pressure.

Key: (1). and σ- decomposition/expansion Na_2CC_3, in the fractions/portions of one. (2). Operating pressure of boiler in Atm(gage).

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For the selection of the diagram of water treatment a quantity of carbonic acid in steam for nonbubbling deaerators should be determined also according to formula (13).

In the presence of deaerator with the bubbling carbonic acid concentration in steam is determined from the formula

$$C_{уг} = 22\,Ш_к x_к (\sigma_1 + \varepsilon) \text{ мг/кг}, \qquad (14)$$

where σ_1— fraction/portion of expansion $NaHCC_3$ in the boiler, equal

to $\sigma_1 = 1 - \sigma_2$; σ_2 — the fraction/portion of expansion $NaHCO_3$ in the bubbling deaerator, tentatively it is possible to accept $\sigma_2 = 0.6$.

9.30. With content of free carbonic acid in steam of more than 20 mg/kg are selected diagrams of water treatment, which lower bicarbonate alkalinity of initial water.

In the cases when the users of steam allow/assume the presence in it of ammonia, is recommended ammoniation of the chemically purified water from the calculation 0.4 mg of ammonia to 1 mg/l of free carbonic acid.

Independent of the content of free carbonic acid (in the absence of ammoniation) should be provided for degassing condensate in the steam-using vehicles by the method of the ventilation of their steam volumes.

9.31. For steam boilers are recommended following diagrams of water treatment:

a) sodium- cationization - for water of household drinking water pipe, if it is admissible in value of blasting of boilers, content of carbonic acid in steam and relative alkalinity; for boilers, which require deep softening, is applied, as a rule, two-stage sodium-

cationization;

b) sodium- caticnization with water treatment by nitrates - for water of household drirking water pipe, if are aged requirements in blasting of boilers, content of carbonic acid in steam, and relative alkalinity of chemically purified water is more than 20o/o (see Section 9.14);

c) hydrogen-sodium-caticnization parallel or consecutive with the "hungry" regeneration of hydrogen-cation filters - for the water of the household drinking water pipe when is required a reduction in the alkalinity, salinity and quantity of carbonic acid in steam;

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d) an ammonium-sodium-caticnization - for the water of the household drinking water pipe when is required a reduction in the alkalinity, content of carbonic acid in steam salinity simultaneously is allowed/assumed the presence in steam of ammonia;

e) sodium-chlorine-ionization - for the water of the household drinking water pipe if necessary or reducing the alkalinity, carbonic acid in steam it is admissible in the value of the blasting of the boilers;

f) bright dipping and ccagulation in accordance with p. 9.21 ("a" - "c") - for the water from the open sources in combination with the diagrams, presented in p. 9.31 ("a" - "e");

g) liming with the ccagulation - for the water of the open sources in cases when is required a reduction in the alkalinity of initial water, oxidizability, content of the iron;

h) internal boiler treatment with the dosage of alkaline reagents - for the boilers, which allow/assume internal boiler treatment in accordance with p. 9.4;

i) thermochemical softening - for the water from the open sources with the predominantly carbonate hardness for the boilers, which allow/assume internal boiler processing in accordance with p. 9.4.

j) magnetic processing - for the water of the household drinking water pipe, in which predominates the carbonate hardness, for the boilers in accordance with p. 9.4.

Selection of the diagrams of water treatment for the additional

feeding of thermal networks/grids.

9.32. Selection of diagram of water treatment for additional feeding of thermal networks/grids depends on requirements for quality of makeup water according to tables 3 of chapter SNiP II-G.10-62.

9.33. Makeup water of thermal networks/grids with closed system of heat supply, in depending on quality of initial water, must undergo bright dipping, coagulation, deaeration and reduction in carbonate hardness to 0.7-1.5 mg•equiv/l, and during preheating of network water in hot-waters boiler - to 0.4 mg•equiv/l.

For the preparation of makeup water of thermal networks/grids with the closed system of heat supply are recommended the enumerated below diagrams of water treatment with the subsequent deaeration:

a) single-stage sodium- cationization - for the water of the household drinking water pipe with the carbonate hardness is less than 6 mg•equiv/l;

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b) a hydrogen-cationization with the "hungry" regeneration of filters - for the water of the household drinking water pipe with the

carbonate hardness is more than 6 mg•equiv/l;

c) coagulation and bright dipping in accordance with p. 9.21 ("a" - "c") with the subsequent realization of the diagrams, indicated in paragraphs 9.33 ("a", "b"), for the water from the open sources;

d) liming and coagulation with the subsequent acidification for the stabilization - for the water of the open sources, which require a reduction in the carbonate hardness.

Notes: 1. With the partial additional feeding of thermal networks/grids by blowoff water of boilers entire remaining makeup water must be deeply softened, for which most advisable is the use/application of a sodium-cationization.

2. With small expenditure of water for additional feeding of thermal networks/grids in boiler rooms with steam boilers as makeup water to rationally utilize feed deaerated water.

9.34. Makeup water of thermal networks/grids with open system of heat supply in depending on quality of initial water must undergo bright dipping, coagulation, deaeration, decontamination and reduction in carbonate hardness to 0.7-1.5 mg•equiv/l, and during

preheating of network water in hot-waters boiler - to 0.4 mg•equiv/l.

The quality of makeup water of thermal networks/grids with the open system of heat supply must satisfy requirements GOST 2874-54 "water drinking".

For the preparation of makeup water of thermal networks/grids with the open system of heat supply are recommended the diagrams of water treatment with the subsequent deaeration and the decontamination:

a) sodium-cationization - for the water of the household drinking water pipe with carbonate hardness $H_к$ ≤ 4 mg•equiv/l;

b) hydrogen-cationization with the "hungry" regeneration of filters - for the water of the household drinking water pipe with carbonate hardness $H_к$ ≤ 4 mg•equiv/l;

c) coagulation and bright dipping - for the water from the open sources in accordance with p. 9.21 ("a" - "c") with the subsequent use/application of diagrams for the water treatment according to p. 9.34 ("a" - "c");

d) liming and coagulation with the subsequent acidification -

for the stabilization of water or the open sources, which require a reduction in the carbonate hardness.

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The decontamination or makeup water is achieved by the method of chlorination or bactericidal radiation/emission by its thermal deaeration.

Equipment and constructions or water-treatment installations.

9.35. Equipment of water-treatment installation must ensure passage in head part of additional quantity of water, which goes for its own needs of water purification: ore washer of mechanical filters, washing of products or regeneration of cationic filters, discharge/break of water with sludge, etc.

In capacity rating of water purifier are considered the total maximum losses of steam and condensate, in this case the losses of production condensate are accepted with consideration the margin of safety, equal to 1.2.

9.36. Temperature of machined water must be not lower than 15-20°C to avoid misting equipment, but not higher than 40°C - for

cationites and 30°C - for anion exchangers according to conditions of chemical strength of ion-exchange materials used.

The oscillations/vibrations of the temperature of water, which enters the clarifiers, which work with the weighed sludge, must not exceed 1° in the hour.

9.37. Equipment and conduits/manifolds, which undergo permanent effect of corrosive environment (weak sulfuric acid, solution/opening of coagulant, common salt, sulfate of ammonium, etc.) must be fulfilled from corrosion-resistant materials or have corrosion-proof coatings.

9.38. Storage of reagents: salt, sulfate ammonium (alumina), etc. one should provide for in wet form.

With the consumption of reagents less than 3 t in month are allowed/assumed to provide for for their storage dry storages.

9.39. For boiler rooms, which do not have central reagent storages (storages of enterprises), reagent storages with boiler room must be designed for storage not less 30-day supply of reagents with delivery/procurement by railroad and 10-day - with delivery/procurement by truck transport on the basis of period of

maximum consumption of reagents.

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9.40. With delivery/procurement of reagents (salt, coagulant, sulfuric acid, etc.) by railroad on reagent storages must be provided for capacities/capacitances, which accomodate heavy duty 50-60- t cars (cisterns).

9.41. Tank volume for "wet" storage of salt and coagulant should be accepted from calculation 1.5 m^3 on 1 t.

The tanks of wet storage of coagulant it is expedient to equip with device for the bubbling or solution/opening.

During the arrangement of reservoirs for the wet storage out of the building should be provided for the devices, which prevent them from the freezing.

9.42. Location for storing of activated carbon and sulfur-coal cationite must satisfy requirements for storages for inflammable materials.

Storage for storing the filtering materials must have a supply

of material, equal to 100% of annual wear.

Unloading the filtering material is manufactured through the branch for the hydro-overload, available in the filters, into the special tank, equipped by drainage system and water-to-water pump for the reverse overload of the filtering material into the filter.

10. Unloading, procedure, storing and supply/feed of solid fuel into boiler room.

10.1. Into fuel economy of boiler room enter devices and constructions for unloading, procedure, storing and supplying fuel/propellant to boilers.

10.2. With delivery/procurement of fuel/propellant by rail transport for its account and weighing are provided for track scales, adjusted, as a rule, on railway station. In the absence of weights on the railway station they must be provided for in the territory of boiler or industrial area/site.

With the delivery/procurement of fuel/propellant into the boiler room by motor transport the weighing of it must be manufactured on the base line (central) storage.

In the absence of weights on the base line storage in the territory of boiler room should be provided for the installation of automobile weights.

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For the boiler rooms with daily consumption of fuel/propellant of less than 20 t these weights can not be established/installed.

Note. Daily consumption of fuel is determined for the mode/conditions, which corresponds to the thermal load of boiler room at mean temperature of the coldest month.

10.3. For boiler rooms with daily consumption of fuel/propellant of more than 250 t in basic channel of fuel feed should be provided for secondary weighing.

10.4. Length of front of unloading and capacity/capacitance of receivers must provide unloading fuel routes of prescribed/assigned weight norm.

For the boiler rooms with daily consumption of fuel/propellant from 250 to 750 t the inclusively weight norm of railroad route must not exceed 1000 t.

For the boiler rooms with daily consumption of fuel/propellant from 750 to 1500 t weight norm must not exceed 2000 t.

For the boiler rooms with daily consumption of fuel/propellant of less than 250 t the value of weight norm of railroad route must be coordinated with the control of iron road.

For the boiler rooms, projected/designed for the distant regions, the length of the front of unloading and the capacity/capacitance of receivers can be accepted more limits indicated above in the connecting/fitting with the actual weight norm of railroad routes for this region.

10.5. Receiving-unloading devices must provide procedure of railroad routes with fuel/propellant with consideration coefficient of 1.2 to nonuniformity of their arrival.

10.6. Front of unloading receiving-unloading device and storage of fuel/propellant, as a rule, is combined. Construction on the storage of the fuel/propellant of two fronts of unloading is allowed/assumed with the special substantiation.

10.7. In receiving-unloading devices must be provided for mechanized cleaning fuel remainders from open freight cars, and also mechanization of unloading congealing fuel/propellant.

10.8. All works on storages must be mechanized. The selection of mechanisms is manufactured in accordance with the technical and economic substantiation.

Note. Use/application for the storage operations of mechanisms and equipment must not lead to considerable size reduction of the fuel/propellant, intended for the layer combustion.

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10.9. Total hourly productivity of mechanisms of fuel depot must provide calculated hourly productivity of fuel feed of boiler room.

10.10. With supply with boilerhouse coal, which requires fragmentation, in channel or fuel feed should be provided for installation of crushing devices.

After the admission of carbon/coal, obtained in an open manner, with the size/dimension of pieces of more than 300 mm is provided for the installation of preliminary breakers.

10.11. In depending on form of fuel/propellant and method of its combustion is recommended use/application of following types of crushers:

during layer combustion of anthracite, stoneware and brown coal, schists - roller- serrated or helical crushers of crash/grating;

during chamber combustion - hammer mills.

For the boiler rooms, intended for the work on the milling peat, crushing devices are not provided. Installation is allowed/assumed only with the special substantiation (heating of Shershnev, etc.).

10.12. Before roller- serrated and hammer mills should be provided for devices for screening of fine/small fractions of fuel/propellant.

10.13. In channel of fuel feed should be provided for installation of electromagnetic separators of sheave and suspension types. With the roller medium-step- and hammer mills the separators should be established/installed before and after crushers.

During the installation of roller-serrated crushers and productivity of fuel feed to 30 t/h is allowed/assumed the installation of one separating device (electromagnetic block or suspension magnet), while with the helical crushers, which have overload safeguard, the installation of electromagnetic blocks is optional.

10.14. For boiler rooms, intended for work on milling peat, one should in the beginning of channel of fuel feed provide for devices for catching of stumps and snags.

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10.15. Calculated hourly productivity of channel of fuel feed of boiler room is determined on the basis of maximum daily consumption of fuel/propellant of boiler room (taking into account prospect of expanding boiler room), number of hours of work of fuel feed in a 24 hour period, but it must be not less maximum hourly consumption of fuel/propellant of boiler room.

10.16. With fuel consumption boiler more than 50 t/h and its supply in hoppers of boilers less than or 16 h is recommended double-thread system of fuel feed. With the smaller fuel consumption and with its supply in the hoppers on 3-4 h is accepted, as a rule,

the unifilar diagram of fuel feed.

10.17. In double-thread system of fuel feed hourly productivity of each thread is accepted equal calculated hourly productivity of channel of fuel feed.

10.18. In unifilar systems of fuel feed is allowed/assumed redundancy of separate assemblies and mechanisms.

10.19. Mode/conditions of work of system of fuel feed is accepted:

in three exchanges - with fuel reserve in hoppers of each boiler it is less than on 10 h of work with its peak output;

in two exchanges - with fuel reserve in hoppers of boilers on 10 h of work and more;

in one exchange - with fuel reserve in hoppers of boilers not less than on 18 h of work.

10.20. In channels of fuel feed must be provided for devices for mechanized retraction of dust (hydro-washing, pneumo-retraction, etc.).

10.21. In channels of fuel feed by productivity of more than 50 t/h must be provided for remote/distance and central control of basic mechanisms and their blocking, and by productivity of less than 50 t/h - remote control and blocking of mechanisms.

11. Removal/distance of slag and ash.

General/common/total indications.

11.1. In boiler installations intended for work on solid fuel, with general/common/total output of slag and ash from boiler room, equal to 200 kg/h and more, processes of removing of slag and ash, as a rule, must be mechanized.

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11.2. For mechanized removal/distance of slag and ash can be provided for mechanical, pneumatic or hydraulic systems.

11.3. Mechanized systems can be provided for with separate or combined removal/distance of slag and ash.

The separate removal/distance of slag and ash must be substantiated by special requirements.

11.4. Capacity/capacitance of hoppers of collection of slag and ash with dry mechanical slag and ash removal should be accepted not more diurnal supply, and with wet mechanical - not more eight-hour supply.

11.5. Hoppers of collection of slag and ashes, arranged/located within building of boiler room, must have capacity/capacitance, which corresponds not less 6-hour output of slag and ash.

11.6. During unloading of slag and ash from hoppers it is necessary to take measures for protection from becoming dusty and pollution/contamination of surrounding territory.

Locations under the hoppers of the collection of slag and ash should be, as a rule, projected/designed closed.

11.7. Redundancy of mechanized systems of removal/distance of slag and ash by trolley is not allowed/assumed.

Mechanical systems.

11.8. Mechanical systems (periodic or continuous transport), as a rule, should be provided for in boiler rooms with boilers, equipped by heatings for layer combustion.

The systems of periodic transport are applied on leaving of slag and ash to 4 t/h; the systems of continuous transport - on leaving not more than 3 t/h.

11.9. For mechanical systems of periodic transport are applied scraper units, skip and other hoists; while for continuous - cable-disk and scraper conveyers, and also slag ejectors of different constructions/designs.

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11.10. Cable scraper units with dry slag and ash removal are provided for:

for transportation of slag and ash of dry fuels/propellants;

during use of slag and ash in industry of building materials;

during prolonged storage of slag and ash or with their distant transport in winter time.

11.11. Cable scraper units with wet slag and ash removal are provided for for transportation of slag and ash which in humid state are not inclined to cementation.

Above the bunker and under the bunker locations, and also locations in which are established/installed the hoppers of the collection of slag and ash, with wet slag and ash removal in the winter time should be heated to temperature of 5°C.

During the installation of hopper on the open pad should be provided for warming its walls.

11.12. For servicing of scraper channel deeply than 1.5 m should be provided for passage corridor with two outputs, and with depth it is less than 1.5 m - possibility of its inspection and repair with device in necessary cases or special pit.

11.13. Use/application of scraper conveyers is recommended for systems of dry slag and ash removal.

11.14. Scraper conveyers are established/installed in impassable channels whose construction/design must allow for possibility of

inspection and repairing separate nodes of conveyor.

11.15. For removing of slag and ash from boiler rooms with boilers, equipped by heatings of manual maintenance/servicing and hourly output of slag and ash it is less than 200 kg/h, one should apply:

narrow-gauge skips; narrow-gauge tubs, moving with the aid of recoiling winches with electric drive;

special skips at pneumatic course;

monorail suspension transport, containers with motor tilting/reversal and self-discharging containers.

Pneumatic systems.

11.16. Pneumatic systems of slag and ash removal, as a rule, should be provided for independent of ignition method of fuel/propellant on leaving of slag and ash from 4 to 12 t/hs.

Note. Sometimes pneumatic slag and ash removal can be accepted on leaving of slag and ash of more than 12 t/h .

11.17. For pneumatic transport of slag and ash from boilers to unloading point up to distance not more than 200 m should be applied exhaust system, and from unloading point up to distance not more than 600 m - forcing system.

11.18. Mode/conditions of work of pneumatic system is received as periodic, moreover its productivity is determined from working conditions for 2 h in exchange, without account to time for switching.

11.19. For fragmentation of slag, which enters exhaust system, under hoppers of boilers are established/installed toothed-rolls crusher.

For the fragmentation of mechanically loose slags with the initial size/dimension of the pieces before the crusher 100-120 mm are established/installed two-roll crushers.

For the fragmentation of slags with the nonuniform fractions or the lumpy with the increased strength with the size/dimension pieces before the crusher not more than 400 mm - three-roller.

The temperature of the slag, which enters the fragmentatic must not exceed 600°C.

11.20. Internal system of slag and ash conduits is fulfill single.

Sometimes it is allowed/assumed to provide for spare general/common/total slag and ash conduit.

11.21. During design or exhaust systems minimum diameters slag and ash conduits should be accepted: for transportation of 100 mm; for transportation of slag - 125 mm.

Maximum/overall diameter of slag and ash conduits - 200 mm

With the calculated diameter of slag and ash conduits of m than 200mm the system should be divided/marked off into two in parallel workers.

The wall thickness of slag and ash conduits should be acce 10-14 mm.

11.22. In exhaust systems for creation of vacuum are appli water-circular vacuum pumps or steam ejectors.

11.23. During design of forcing system of airslide of slag and ash should be applied two-chamber air pumps, pneumatic screw pumps or compressors.

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Hydraulic systems.

11.24. Hydraulic systems of slag and ash removal, as a rule, should be provided for during chamber combustion of fuel/propellant and output/yield of clinkers 12 t/h and more.

11.25. Design of hydraulic systems of slag and ash removal must be fulfilled in accordance with requirements for design of these systems for electrical stations.

12. Unloading, procedure, storing and supply/feed of liquid propellant into the boiler room.

12.1. Liquid propellant is utilized in boiler room as:

basic - during entire operating cycle of boiler room;

spare - during prolonged period, for example in winter months

during use in remaining season of gas;

emergency - during brief curtailment of gas supply;

kindling - for kindling and "illumination" of heatings during dustlike combustion of solid fuel.

12.2. Overflow of liquid propellant from railroad or automobile cisterns is provided for:

by gravity flow through lower drainage tool;

by means of siphon through top of cistern or with the aid of pumps with power drive with overflow of solar oil.

12.3. Length of front of overflow of petroleum residue, which is basic or spare fuel/propellant and furnished by railroad, must provide overflow not more than into two bets of 48-hour expenditure of petroleum residue; for petroleum residue, which is emergency fuel/propellant, 0.7 daily consumptions.

12.4. Drainage devices for solar oil must be provided for reception of one railroad or automobile cistern.

12.5. Fuel/propellant from cisterns is drawn off directly in fuel reservoir or into receiving (intermediate) capacity/capacitance with subsequent pumping or its overflow in fuel reservoir.

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The selection of the diagram of fuel dumping is manufactured in the dependence on area relief and type of reservoirs.

12.6. With delivery/procurement of fuel/propellant in railroad tank cars in depending or daily consumption of fuel/propellant value of receiving (intermediate) capacity/capacitance is accepted according to Tables 20.

12.7. For boiler rooms with rating 350 t/h and below with delivery/procurement of petroleum residue by rail transport receiving capacity/capacitance of petroleum residue, intended for kindling, it must be equal to 25 m^3 under condition of its simultaneous pumping in fuel reservoir, while for boiler rooms of larger productivity

- 50 m. With the feed of the fuel by motor transport, the magnitude of the receiving capacity is taken equal to the capacity of the reservoirs being drained.

12.8 Receiving chutes are provided to drain the fuel through the lower drain device of the railroad tank cars.

With the delivery of the fuel by motor transport, the drain of the fuel into the receiving tank or directly into the fuel tank is produced by the receiving chutes or through funnels.

12.9. The chutes and tubes along which the fuel is drained into the fuel tank or receiving (intermediate) tank must be done with a slope of not less than 0.01 for mazut [black oil] and 0.005 for solar oil.

An apparatus of the hydraulic or other type of valve and also a lifting screen grid for the coarse cleaning of the black oil must be provided between the chute (tube) of the drain devices and the receiving tank or in the tank itself.

12.10. When the distance of the fuel tank is at more than 1 km, with the appropriate substantiation on the site of the boiler, the construction of flow reservoirs with a total capacity equal to a two-day flow of fuel is allowed.

Table 20

Magnitude of receiving (intermediate) capacity

(1) Суточный расход топлива в т для нагрузки при средней температуре самого холодного месяца	Величина (2) приемной емкости для склада топлива в м³	
	основного и резервного (3)	аварийного (4)
(5) До 75	25	25
Более 75 до 150	50	25
» 150 » 300	100	25
» 300 » 1000	200	50
» 1000	400	50

Key: (1) Daily flow rate of fuel in tons for loading at mean temperature of the coldest month; (2) Magnitude of the receiving capacity for the storage of fuel in m^3: (3). basic and spare. (4). emergency. (5). To. (6). It is more.

A quantity of the feed tanks must be not less than two: is allowed/assumed the construction of one reservoir with the device between the fuel pipes of the cross connection, which makes it possible to manufacture the supply/feed of fuel/propellant from the basic depository to the boilers, passing the feed tank.

During the construction on the pad of the boiler room of the feed tanks the reserve of fuel, stored out of the area/site of boiler room, respectively is decreased.

12.11. For storing solar oil should be provided for metallic reservoirs.

12.12. Equipment of reinforced-concrete and metallic reservoirs of fuel reservoirs, of service tanks, adjusted in boiler room, and also other devices of fuel economy must correspond to requirements of in force "Norms and technical specifications of planning of storage enterprises and economies for storing inflammable and flammable liquids" (NiTU 108-56).

12.13. For ground-based metallic fuel reservoirs must be provided for heat insulation.

12.14. Drainage devices must have attachments for heating of fuel/propellant before overflow from railroad tank cars.

The temperature of heating should be accepted: for the petroleum residue of brand "40" -30°C; for the petroleum residue of brand "100" -60°C; for the solar oil - 10-15°C.

The fuel/propellant, delivered to the area/site of boiler room in the automobile cisterns, as a rule, must be located in the heated state.

12.15. Chutes/trays and ducts, along which is drawn off fuel/propellant, are equipped by devices (coil, duct) for maintaining temperatures of petroleum residue, indicated in p. 12.14.

12.16. In fuel reservoirs, and also in receiving (intermediate) capacity/capacitance should be provided for heating of petroleum residue to temperature: for petroleum residue of brand "40" -40-60°C: for petroleum residue of brand "100" -60-80°C; for petroleum residue of brand "200" -70-90°C.

For the sulfurous petroleum residue of brands "40" and "100" temperature of heating must be within limits of 70-80°C.

The smaller values of temperatures are received with the pumping

of fuel/propellant as helical and gear pumps, large - by the centrifugal pumps; for piston and plunger pumps are accepted the average/mean values of temperatures.

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The heating of solar oil in the fuel reservoirs and in the receiving capacity/capacitance is not required.

12.17. Heating of petroleum residue in fuel reservoirs to temperatures, indicated in p. 12.16, is manufactured due to circulation of fuel/propellant through separate surface/skin preheaters.

The introduction/input of fuel/propellant into the reservoirs (fuel reservoir) is accomplished/realized through the special nozzles. A quantity of nozzles and a place of their installation are determined in depending on the type of reservoir and volume of the circulating petroleum residue. The supply/feed of fuel/propellant into the reservoirs to the upper level of petroleum residue is not allowed/assumed.

12.18. In receiving (intermediate) capacities/capacitances are provided for built-in preheaters for heating of petroleum residue.

12.19. In reservoirs it is necessary to provide for diversion/tap of randomly caught water.

12.20. Heating of petroleum residue to temperature, necessary for its pulverization/atomization in injectors of boilers, is provided for in surface/skin preheaters.

It is established/installed not less than two such preheaters of which one reserve; for the boiler rooms by coefficient of evaporation to 10 t/h is allowed/assumed the installation of one preheater.

12.21. Temperature of petroleum residue, supplied to injectors of boilers, is accepted according to data of Table 21.

Table 21.

(1) Форсунки	(2) Температура в °С для мазута марки		
	40	100	200
(3) Механического или паромеханического распыления	100	120	130
(4) Механического распыления (ротационные)	85	105	110
(5) Воздушного распыления низконапорные	90	110	115
(6) Парового или воздушного распыления высоконапорные	85	105	110

Notes: 1. For the petroleum residue of brands 40 and 100 before the rotational injectors is allowed/assumed a reduction in the temperature of the heating of petroleum residue to 60°C.

2. During treatment of petroleum residue liquid additives temperature of its heating must be not lower than 110°C.

3. In the case of using mixture of petroleum residue of different brands/marks temperature of heating is accepted on heaviest petroleum residue.

Key: (1). Injectors. (2). Temperature in °C for petroleum residue of brand/mark. (3). Mechanical or steam-mechanical pulverization/atomization. (4). Solid injection (rotational). (5). Air pulverization/atomization low-pressure. (6). Steam or air pulverization/atomization high-pressure.

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12.22. Temperature of heating of petroleum residue in open service tank, to avoid foaming, must be not more than 90°C.

12.23. With delivery/procurement of fuel/propellant by railroad or by truck transport is provided for two-stage decontamination - filters of rough and fine purification.

Coarse filters are established on the suction line of the pumps, which feed fuel/propellant in the boiler room or pumping over it of the intermediate capacity/capacitance in the fuel reservoirs.

Fine filters are established after the preheaters, which heat the petroleum residue, which enters the boilers.

12.24. Quantity of adjustable filters probably as a rule, not less than two.

For the boiler room coefficient of evaporation 5 t/hs and is allowed/assumed below the setting up of one filter with the device of bypass line for the possibility of its cleaning.

12.25. For petroleum residue with content of sulfur more than 0.5o/o are recommended the providing for of liquid additives.

Reception, storage and mixing of liquid additives with the petroleum residue must be provided for taking into account the following requirements: with the delivery/procurement of petroleum residue by rail transport the capacity/capacitance for the receiving of additives must be equal to the capacity/capacitance of the railroad tank cars, but not less than two on 25 m^3, and with the delivery/procurement by motor transport - not less than 1o/o capacity/capacitance of mazut tank.

Mixing and preheating of petroleum residue are manufactured in accordance with the acting ccazards.

12.26. Contaminated by petroleum residue drainages and fuel remainders from trimming of reservoirs are subject to use as fuel/propellant of boiler room. The discharge/break of the drainage water, contaminated by petroleum residue, and water from petroleum residue trap into the canalization/sewerage is not allowed/assumed.

12.27. Supply/feed of fuel/propellant from fuel reservoir to

injectors of boilers, as a rule, is fulfilled on circulation diagram.

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It is allowed/assumed to project/design the blind diagram of the supply/feed of fuel/propellant for the boiler rooms with coefficient of evaporation 10 t/hs and it is below, and also for the boiler rooms of any productivity, which consume the nonsulfurous petroleum residue of brand 40 and solar oil as the emergency or the kindling.

12.28. In depending on diagram accepted for supplying fuel/propellant from fuel reservoir to boilers is established following quantity of pumps:

in circulation diagram - is not less than two, including one spare; for boiler rooms by coefficient of evaporation of more than 85 t/hs during the supplying of basic or spare fuel/propellant - not less than three, of which one spare;

in blind diagram - two, including one spare.

At a pressure of the petroleum residue before the injectors 20-35 kgf/cm^2 for the system of circulation preheating should be established not less than two additional low-pressure pumps.

12.29. Depending on diagram of supply/feed of fuel/propellant from fuel reservoir to injectors capacity of all working pumps must be:

in circulation diagram - not less than 150o/o actual hourly consumption of fuel/propellant with work of all boilers with full/total/complete coefficient of evaporation; in this case volume of recirculation comprises not less than 500/0

in blind diagram with service tank - from calculation of its filling for 1 h.

12.30. For pumping of fuel/propellant of receiving (intermediate) capacity/capacitance in fuel reservoir must be provided for not less than two pumps (both workers), while for boil rooms productivity is is 10 t/hs and below - one pump.

12.31. For supplying fuel/propellant from fuel reservoir, whic is located out of area/site of boiler room (see Section 12.10), int feed tanks, arranged/located with boiler room, must be provided for two pumps (against workers), while for boiler rooms by productivity is is 10 t/hs and below - one pump.

The capacity of these pumps is selected from the condition of the filling by them of the feed tanks for 4-7 h.

12.32. Schematic of connection of pumps to reservoirs must provide independent work of each pump from any reservoir, and also possibility of pumping of fuel/propellant in any of established/installed reservoirs.

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12.33. Fuel pumps should be provided for with electric drive. Sometimes is allowed/assumed the use/application of pumps with the steam drive.

These pumps should be established under the molded edge/gulf.

The locations of fuel pumping ones, as a rule, should be provided for ground-based.

12.34. All fuel lines should be projected/designed single ones.

Spare conduits/manifolds for supplying the fuel/propellant to

the injectors of boilers are provided for only in the boiler, intended for the maintenance/servicing enterprises with the continuous technological process.

12.35. All the equipment, conduits/manifolds and fittings must be isolated/insulated.

The warmed fuel pipe is projected/designed in one insulating jacket with the satellite.

12.36. Packing of fuel pipes and heating mains should be provided for with ground-based or in impassable channels with removable overlaps without filling.

13. Layout of boiler rooms.

13.1. Volumetrically-planning solutions of buildings and constructions of boiler rooms are accepted within section of 4 chapters SNIP [- Construction norms and regulations] II-g.9-65 "Boiler installations. Norms of planning".

13.2. During planning of boiler rooms to setting up should be accepted boiler units and accessory equipment in plant or standard layout.

The development of new equipment installations is allowed/assumed only in the absence of the plant or standard solutions, and also during the reconstruction of boiler rooms.

13.3. Boiler and accessory equipment to it - blast fan, exhaust fan, gas purification, tail heating surfaces, etc. should be fulfilled on aggregate diagram.

During the reconstruction boiler or other specific conditions (absence of corresponding equipment, etc.) is allowed/assumed the execution of the group layout of the forced-draft, ash-catching installations and tail heating surfaces.

13.4. Installation of boiler units in boiler room should be provided for single-row. The front of boilers is recommended to furnish into one line of turned to the windows boiler room.

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13.5. With device of passage corridor, intended for routine inspection and repairing mechanisms of slag and ash removal, latter must have sizes/dimensions on height not less than 1.9 m to bottom of

protruding constructions/designs, in width - not are less than 1 m and two outputs/yields outside, of which one must have inclined staircase, but by the second it can be carried out on brackets through opening outside hatch.

13.6. Layout of accessory equipment (water heaters, pumps, filters, deaerators, etc.) should be made of condition of guaranteeing free pass not less than 0.8 m of protruding equipment components and adjustable by hand catches.

13.7. For assembly and repairing of boilers, exhaust fans, mills, fans, pumps, electric motors and another accessory equipment with weight of removable parts more than 100 kg it is necessary to provide for setting up of corresponding attachments for production in repair and load-lifting works.

13.8. Fuel reserve in hopper of boiler is recommended to accept according to design considerations, but not less than 3 h of work of boiler with 100o/o load.

13.9. During combustion of wood withdrawals/departures in high-speed/high-velocity heatings fuel reserve in hoppers (hoses/pipes) is accepted from 30 min to 1.5 h.

During the combustion of wood withdrawals/departures in the mine/shaft heatings fuel hoppers are not provided for, in this case is manufactured direct fueling into the heating on the mark of its charging mine/shaft.

14. Automation and heat engineering check.

14.1. During planning of boiler rooms must be solved questions: automatic control; automation of safety; heat engineering check; signaling; and automatic remote control.

The composition and the content of these sections of projects must correspond to the requirements of "Indications by planning of the automation of production processes" (SN 281-64).

14.2. Automation of boiler rooms can be full/total/complete, complex or partial.

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Full/total/complete automation provides for the automation of entire equipment and the operation of boiler rooms without the permanent service personnel;

complex - automation of the basic equipment of boiler rooms during their operation by the permanent service personnel;

partial - automation of the separate types of equipment by boiler room.

Degree of the automation of boiler rooms and technical equipment for the automation are accepted on the basis of the corresponding technical and economic substantiation.

Note. During the determination of annual expenditures from the boiler rooms with different degree of automation one should accept the 5-year payback period additional capital investments upon the automation.

14.3. During development of designs of automation it is to be guided by following basic condition/positions:

quantity of means of automation must be minimum, but sufficient for guaranteeing reliable and economical work of equipment with boiler room;

must be used serially produced tools and equipment;

during development of structures must be provided for laying parts and parts, necessary for assembly of means of automation and heat engineering check;

constructions/designs of technological equipment and conduits/manifolds must provide for setting up of means of automation and check (branch, nipples, flange joint for measuring diaphragms, control valves, etc.);

the constructions/designs of the parels of automation and check must satisfy the requirements of the prefabrication;

the setting up of the means of automation must be manufactured, as a rule, on the acting standards and the standard drawings with the maximum use of parts of prefabrication.

Note. The use/application prototypes of tools, and also imported equipment is allowed/assumed only when of the corresponding technical and economic substantiation and agreements of the possibility of their delivery are present,.

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14.4. In boiler room can be established central, group or local

panels of automation and check, on which are placed basic tools of heat engineering check, equipment for automatic control, automation of safety, signaling and remote control.

14.5. With full/total/complete automation of group of boiler rooms should be provided for construction of control room to panel of which will be carried signaling of emergency cutoff/disconnection of equipment of serviced boiler rooms or emergency state of controlled/inspected parameters. In this case in the boiler rooms one should place local panels or local devices and means of automation directly in equipment.

14.6. By complex and partial automation selection of type of panel (local, group or central) is manufactured on basis of corresponding substantiation taking into account convenience in operation.

14.7. Automation and heat engineering check of boiler rooms, equipped by boilers with chamber combustion of solid fuel, are made in accordance with "Technical operation instructions of electrical stations and networks/grids".

Automatic control.

14.8. Automatic combustion control should be provided for all boilers, which work on liquid or gaseous fuel, and on solid fuel - in the case of applying mechanized combustion systems, which make it possible to automate their work.

Notes: 1. The need for the automation of the processes of combustion with the work of boilers on spare fuel/propellant is determined by the technical and economic substantiation, carried out taking into account the estimated time of the work of boilers on this form of fuel/propellant.

2. For emergency fuel/propellant automation of processes of combustion is not provided for.

14.9. For all steam boilers one should provide for automatic feed control. For the boilers by the coefficient of evaporation of more than 2 t/h the setting up of feed regulators is necessary.

14.10. In boiler, intended for servicing only buildings with person's periodic stay (institution, production and entertainment enterprises, etc.), one should allow for possibility of program control of heat distribution for purpose of fuel economy due to reduction in temperature of locations in periods of person's absence.

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14.11. Additional feeding of systems of heat supply must be accomplished/realized automatically.

14.12. For deaerators should be provided for automatic water-level control and pressure of vapor.

With the multiple operation of several deaerators, as a rule, is provided for group automatic control.

14.13. For reduction installations should be provided for automatic pressure adjustment of reduced vapor, for pressure-reducing and cooling installations - pressure and temperature and for refrigeration plants - temperature control.

14.14. For water-treatment installations is provided for automatic temperature control of preheating damp/crude water (if water treatment has clarifiers).

14.15. For water-heating heat installations is provided for automatic temperature control of network water, while for water-heating installations of hot water supply - automatic maintenance of temperature constancy of water.

14.16. Temperature control of preheating and pressure of liquid propellant must be automated.

14.17. For wet ash catchers is provided for automatic maintenance of fixed level of water in pressure tank.

Automation of safety.

14.18. Equipment of boilers by automation of safety with work on gaseous and liquid propellant is necessary.

14.19. For steam boilers by pressure of more than 0.7 Am(gage) it is necessary to provide for curtailment of supply/feed of gaseous or liquid propellant in the case:

vapor pressure increase pair in boiler barrel;

lowering air pressure (for mixing gas burners);

lowering gas pressure;

decrease of rarefaction/evacuation in heating of boiler;

increase or lowering water levels in boiler barrel;

extinction of flame in heating of boiler;

malfunction of equipment for automation of safety.

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14.20. For hot-water boilers with temperature of heating water of higher than 115°C it is necessary to provide for curtailment of supply/feed of gaseous or liquid propellant in the case:

increase in temperature of water after boiler;

lowering pressure of water after boiler;

lowering air pressure (for mixing gas burners);

lowering gas pressure;

decrease of rarefaction/evacuation in heating of boiler;

decrease of flow rate of water through boiler;

malfunction of equipment for automation of safety.

14.21. For steam boilers by pressure to 0.7 Am (gage) and water-heating ones with temperature of heating water to 115°C it is necessary to provide for curtailment of supply/feed of gaseous or liquid propellant in the case:

increase in temperature of water after boiler (for hot-waters boiler);

increase or lowering in gas pressure;

lowering pressure of water;

vapor pressure increase (for steam boilers);

decrease of rarefaction/evacuation in heating;

extinction of flare in heating of boiler;

malfunction of equipment for automation of safety.

Heat engineering check.

14.22. During determination of volume of heat engineering chec cf boiler rooms should be been guided following basic condition/positions:

parameters observation of which is necessary for correct condu of established/installed modes/conditions of operation of boiler rooms, it is to control with the aid of reading instruments;

Note. In the fully automated boiler rooms it is allowed/assume instead of the reading instruments to provide for choice devices fo the connection of portable instruments.

the parameters whose change can lead to the emergency state of equipment, it is to control with the aid of the signalling tools;

the parameters whose account necessary for the analysis of wor of equipment and profit and loss accounting, is to control with the aid of the recording or summing instruments.

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14.23. During remote control of several similar/analogous

parameters is recommended use/application of general/common/total showing or recording measuring meter.

14.24. One should provide for instrumentation with combined functions: reading and recording, recording and addition, etc.

14.25. Steam boilers by pressure of more than 0.7 Am(gage) must be equipped by reading instruments for measurement:

a) temperature of vapor after steam superheater;

b) temperature of feed water before boiler and economizer;

c) temperature of feed water after econcmizer;

d) temperature of flue gases after boiler;

e) temperature of flue gases after tail heating surface;

f) pressure of vapor in boiler barrel;

g) pressure of vapor after steam superheater;

h) pressure of steam, supplied to pulverization petroleum

residue;

i) the pressures of the feed water before the organ/control, which gauges the feed of the boiler; in boilers by productivity are less than 2 t/hs - pressure in the general/common/total supply main;

j) the pressure of feed water at the entrance into the economizer to the close fitting valve and at the output/yield from the economizer to the close fitting valve (with the disconnected on the water economizers).

k) air pressure after blast fan, after each regulating unit for the boilers, which have zone blasting, or pressures before the burners when the devices of those gauging are present, the air flow rate to the burners, and also air pressure before the spreaders;

l) the pressure of liquid or gaseous fuel before the burners after the control fitting;

m) rarefaction/evacuation in the heating of the boiler;

n) rarefaction/evacuation before the damper or guiding device of the exhaust fan; for the boilers, which do not have exhaust fan, before the damper in the flue;

o) rarefaction/evacuatica befcre and after the tail heating surfaces;

p) expenditure/ccrsumptica cf steam frca the bciler (summing instrument).

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q) for level measurement ia the boiler barrel are established cne water-gauge tool cf direct action and additionally two lcwered level indicators, if water level ia the drua is fcund at the height cf more than 6 m of the maintenance platfora, and also in the case of the poor visibility of water-gauge tools.

r) contents CO_2 or C_2 in the stack gases, as a rule, by movable gas analyzers for the bciler by ccefficient cf evaporation tc 30 t/hs; for the boilers cf larger prcductivity and by automatic gas analyzer.

14.26. Hot-waters bciler with temperature of heating water of more than 115°C are equipped by reading instruments in accordance with p. 14.25 d, e, k, l, m, n, c, p and by additional tools cf

measurement:

a) temperature of water at entrance into boiler (after close fitting valve) and at output/yield from boiler (to close fitting valve);

b) pressure of water at entrance into boiler (after close fitting valve) and at output/yield from boiler (to close fitting valve);

c) flow rate of water through boiler (for boilers by productivity it is more than 10 gcal/h);

d) contents CO_2 or C_2 in the stack gases, as a rule, by movable gas analyzers for the boilers by heating power to 10 gcal/h, for the boilers of larger productivity - by an automatic gas analyzer.

14.27. Steam boilers with pressure not are more than 0.7 Am(gage) and hot-waters boiler with temperature of water not more than 115°C are equipped by reading instruments for measurement:

a) temperature of stack gases;

b) temperature of water at entrance into boiler (after close

fitting valve);

c) temperature of water at output/yield from boiler (to close fitting valve) for hot-waters boiler;

d) pressure of vapor in boiler for steam boilers;

e) air pressure after blast fan;

f) the pressure of water at the output/yield from the boiler (to the close fitting valve) for hot-waters boiler;

g) rarefaction/evacuation in the heating of the boiler;

h) rarefaction/evacuation before the exhaust fan.

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14.28. In boiler rooms are established reading instruments for measurement:

a) temperature of water in feeding and return lines of thermal network/grid;

b) temperature of liquid propellant in general/common/total force main;

c) pressure of vapor in general/common/total main line to injectors of atomization of liquid propellant;

d) pressure of water in intake connecting pieces of network pumps (after close fitting valve) and in forcing connecting pipes of network, feed and condensate pumps (to close fitting valve);

e) pressure of heated water in common line to preheaters and after each preheater;

f) the pressure of water in the feeding line of the thermal network/grid;

g) the pressure of water in the feed conduit/manifold (after control fitting);

h) the pressure of liquid or gaseous fuel in common force mains;

i) the consumption of liquid or gaseous fuel as a whole on the boiler room (summing instrument).

14.29. In boiler rccms are established recording instruments for measurement:

a) temperature of superheated steam, intended for technological targets (in common steam header);

b) temperature of water in delivery pipes of thermal network/grid and hot water supply and in each return line;

c) pressure of steam in delivery pipe or in common collector/receptacle;

d) pressure of water in return line of thermal network/grid;

e) flow rate of steam in feeding steam supply (summation flowmeter indicator);

f) the flow rate of water in each delivery pipe of thermal network/grid and hot water supply (summation flowmeter indicator);

g) the expenditure of the water, which goes for the additional feeding of thermal network/grid (summation flowmeter indicator).

Note. With the flow rate of water of less than 2 t/hs flow gauge

it is possible not to establish.

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14.30. Deaerating-feed installations are equipped by reading instruments for measurement:

a) temperature of water in battery and supply tanks or in appropriate conduits/manifolds;

b) pressure of steam in deaerating column and in closed type tanks (with steam pillow);

c) pressure of steam in steam feed pumps;

d) pressure of feed water in each main line;

e) pressure of water in intake and forcing connecting pieces of feed pumps;

f) water level in battery and supply tanks.

14.31. Reduction and pressure-reducing and cooling installations are equipped by reading instruments for measurement:

a) temperature of superheated steam in supplying steam supply;

b) temperature of cooled reduced vapor;

c) temperature of cooling water;

d) pressure of steam in supplying steam supply;

e) reduced vapor pressure;

f) pressure of cooling water;

g) flow rate of steam in supplying steam supply or in steam supply of reduced vapor.

Note. In such cases when flow rate of steam can be determined according to a difference in readings of flow gauges, established/installed in other places, or steam is utilized only for its own needs of boiler room, flow gauge it is possible not to establish.

14.32. Water-heating installations are equipped by reading

instruments for measurement:

a) temperature of heated water in common duct to preheaters and heated water after each preheater;

b) temperature of heating water in common duct to preheaters and after each preheater, and also temperature of condensate;

c) vapor pressure of heating before water heaters (after control fitting).

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14.33. Water-treatment installations are equipped by reading instruments for measurement:

a) temperature of damp/crude water;

b) pressure of damp/crude water;

c) pressure of water before and after each filter;

d) pressure of compressed air (in main lines);

e) flow rate of water, which enters each ionite filter and after each mechanical filter;

f) expenditure of water, which goes for loosening of ionite and mechanical filters;

g) flow rate of water before ejector of preparation of regeneration solution/opening;

h) the common expenditure of the water, which enters for water-treatment installation (summation flowmeter indicator).

14.34. In mazut-pump are established reading instruments for measurement:

a) temperature of heating steam (water);

b) temperature of fuel/propellant in reservoirs;

c) temperature of fuel/propellant before and after preheaters;

d) pressure of fuel/propellant in common line to pumps and in forcing connecting pieces of each pump;

e) pressure of fuel/propellant before and after filters;

f) pressure of fuel/propellant before and after heat exchangers;

g) fuel level in reservoirs.

14.35. Control of work of ash catchers (multicyclone dust collectors, cyclones of type NIICGAZ, etc.) is accomplished/realized periodically with the aid of reading instruments.

14.36. System of pneumatic slag and ash removal is equipped by reading instruments for measurement:

a) temperature of superheated steam for ejecting vacuum system;

b) vacuum in air duct between sedimentation rock and vacuum system;

c) vacuum at entrance into slag crusher after close fitting valve;

d) vacuum at output/yield from vacuum system to close fitting valve;

e) air flow rate in air duct between cyclone-precipitator and vacuum system.

14.37. System of hydraulic ash removal is equipped by reading instruments for measurement:

a) pressure in force mains of washing, irrigating and ejection water;

b) pressure in forcing connecting pieces of dredge and sludge pumps (or hydroapparatuses).

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14.78. During planning of heat engineering control of fully automated boiler rooms is allowed/assumed decrease of quantity of monitoring and measuring tools with appropriate substantiation.

Signaling.

14.39. For warning/preventing service personnel about deviation of parameters from norm or emergency state of equipment must be provided for signaling.

14.40. In fully automated boiler rooms, which work without permanent service personnel, alarm signal will be carried to control room.

On the local panel is fixed/recorded the reason of the call of the service personnel.

14.41. In boiler rooms with permanent service personnel is provided for signaling to panel:

a) reasons for failure of fuel during setting up of boilers wit automation of safety;

b) pressure increase of steam in boiler barrel with work on solid fuel;

c) increases and lowerings in water level in boiler barrel for boilers by coefficient of evaporation 2 t/hs are above;

d) lowering fuel level in hopper of boiler;

e) increase in temperature of water after each hot-water boiler with work on solid fuel;

f) increase and decrease in temperature of liquid propellant in general/common/total petroleum duct;

g) lowering the pressure of gaseous or liquid propellant in the conduit/manifold;

h) lowering the pressure of feed water in each conduit/manifold;

i) lowering the pressure of water in return line of the thermal network/grid;

j) increase or lowering water levels in the battery tank of the system of hot water supply, the tank of the collection of condensate, tank of feed water, etc.;

k) raising the level in the hoppers of the ash catchers;

l) malfunction in the mazut-pump during the operation without the permanent service personnel.

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14.42. For electric motors, controlled from panels of automation and control, is projected/designed light and sound communication of

their emergency shutdown or signaling of nonconformity between state of mechanism (it is working, it is nonoperative) and position of key/wrench of control.

Administration of electric drives.

14.43. Controls of mechanisms, as a rule, should be placed on the same panels (panels) or next to them, on which are arranged/located tools, which check work of these mechanisms. During the arrangement/position of measuring meters about the serviced equipment remote control made should not be.

14.44. It is direct in electric motors, controlled remotely/distance, must be provided for equipment for their emergency stop.

14.45. For boiler aggregates/units must be provided for blocking exhaust fans, blast fans and devices of supply/feed of fuel/propellant.

14.46. With stop of feed, network, makeup pumps and pumps of liquid propellant with electric drive should be provided for automatic breaking of reserve.

14.47. Measurement of current strength is made in circuits of those electric motors where it is necessary for systematic control of work of thermo-mechanical equipment.

14.48. Schematics of starting/launching blockings of mechanisms of fuel feed and slag and ash removal must be carried out by such form, in order to start and stop (including emergency) electric drives they were accomplished/realized in specific sequence, which eliminates avalanche of separate mechanisms by fuel/propellant or slag and by ash.

14.49. For wet ash catchers are provided for following blockings:

a) during coverage of close fitting valve on water pipes, which feed sprinkling nozzles and injectors, is opened/disclosed close fitting valve, established/installed on drainage water pipes in ash location:

b) control of washing nozzles of inlet elbows must be interlocked with close fitting valve on water pipe, which feeds washing nozzles.

15. Technical and economic indices of boiler rooms.

15.1. Technical and economic indices of boiler rooms are comprised during development of designed assignments and working drawings of standard and individual designs, and also with joining of standard projects.

The technical and economic indices, which must be connected with the composition of the designed assignment to boiler room, are given below.

Calculated heating power boiler ... gcal/h.

Among other things:

heat in the form of water with the temperature (t= ... °C) ... gcal/h.

steam (pressure P=atm(gage), temperature t=°C) ... t/h.

The annual output of the heat ... of thousand of gcal.

The annual leave of heat tc the csers:

water ... of thousand of gcal.

steam ... t.

Established/installed heating pcwer boiler (tctal heating power of the established/installed bcilers) ... gcal/h cr t/h.

Total hours of utilizatica of the established/installed heating pcwer cf the boilers ... h/year.

Consumption of natural fuel ... t/yr (thcusand cf nm^3/yr).

Consumption of reference fuel (Q_H^P =7000 kcal/kg) ... thousand of t of conv. fuel/year.

Established/installed electrical pcwer of the current-collecting devices:

a) power ... kW.

b) illuminating ... kW.

Maximum electrical load (total power and illuminating) ... kW.

Expenditure/consumption of electric power ... of thousand kW•h/year.

Expenditure/consumption of water (taking into account the economic needs) ... of thousand of m^3/year.

States/staffs of the boiler room ... of organic units.

Total construction volume of buildings and constructions, entering the complex of the boiler room ... m^3.

Area of the territory, necessary for positioning/arranging of buildings and constructions of the boiler room ... m^2 or GA.

Area of building-up by buildings and by constructions ... m^2 or GA.

Coefficient of building-up ... o/o.

Estimated cost/value of the building of boiler ... thousand of rub.

Among other things:

the general-construction works ... of thousand of rub.

the special construction work ... of thousand of rub.

equipment and assembly ... of thousand of rub.

Total annual operating costs ... of thousand of rub.

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Specific indices.

Capital investments on 1 gcal/h of the established/installed heating power of boiler room ... (thousand of rub)/(gcal/h).

Estimated cost/value of 1 m^3 of the buildings of the boiler room ... of rubles/m^3.

Construction volume of buildings and constructions on 1 gcal/h of the established/installed heating power of the boiler room ... (m^3)/gcal/h).

among other things volume of the building of boiler room on 1 gcal/h of the established/installed heating power of boiler room

(m³)/(gcal/h).

Established/installed electrical pcwer of current-collecting devices cn 1 gcal/h of the heating pcwer cf boiler rccm ... (kW)/(gcal/h).

Consumption of reference fuel per 1 gcal of the manufactured heat ... kg/gcal.

Then, the heat, tempered to the users ... kg/gcal.

Prime cost 1 gcal of the tempered heat ... rutles/gcal.

Amcng other things fuel ccmpcnent ... rutles/gcal.

Ihen ... o/o.

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Nc typing.


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